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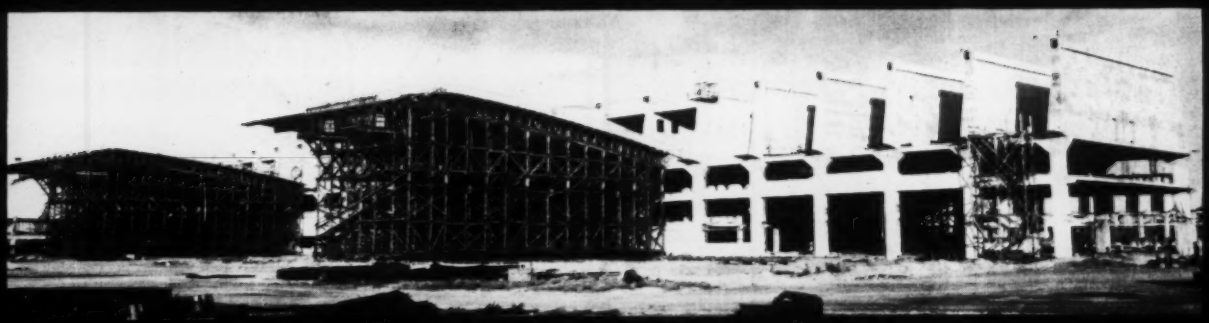

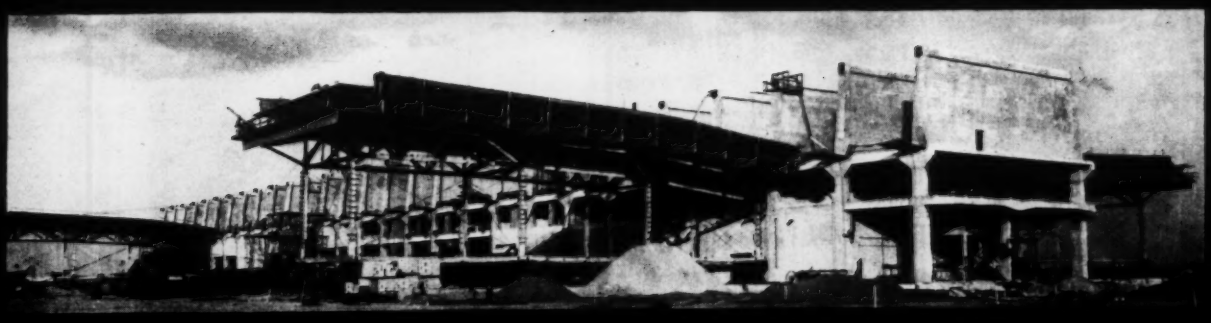

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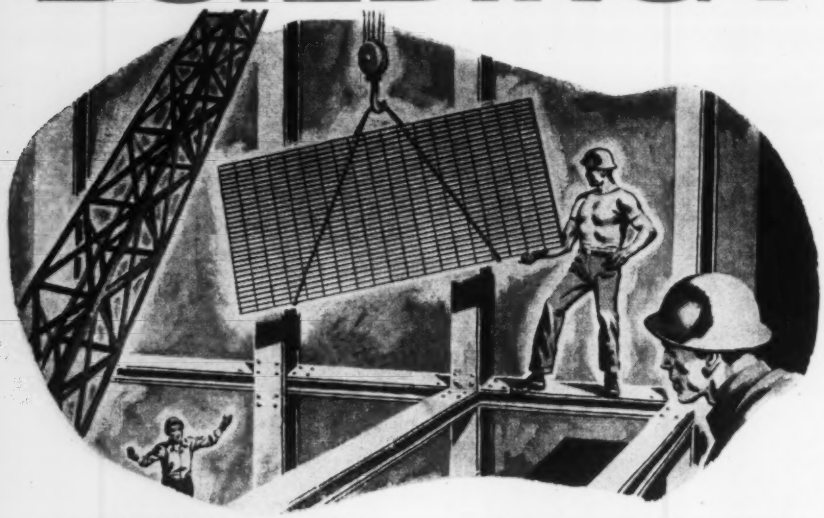

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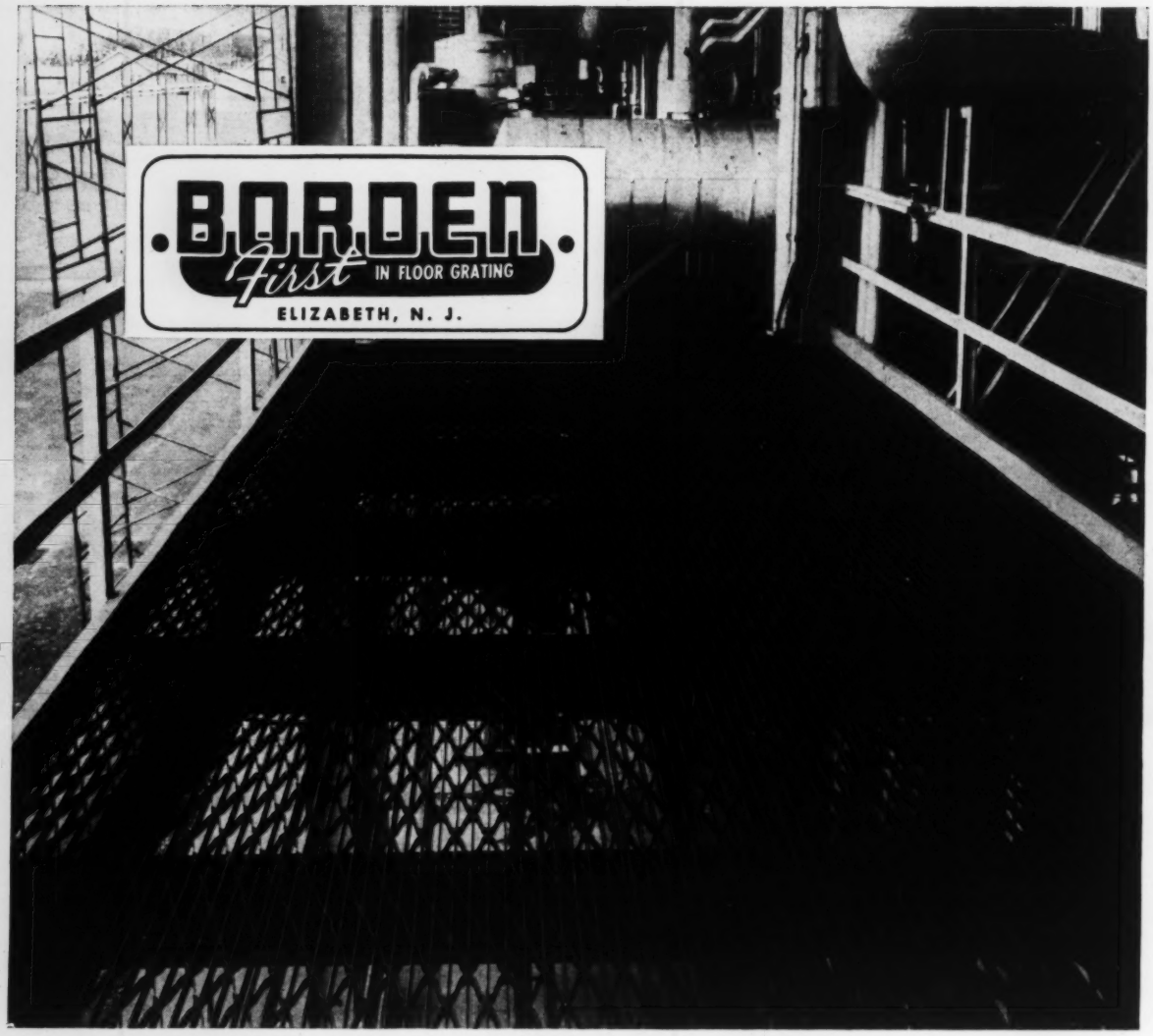

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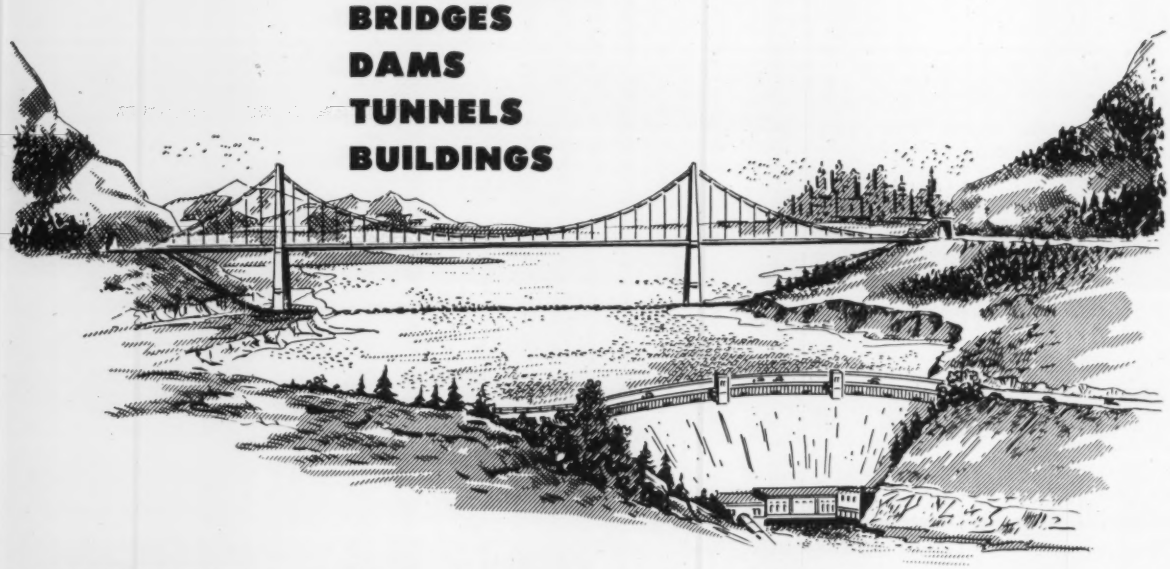

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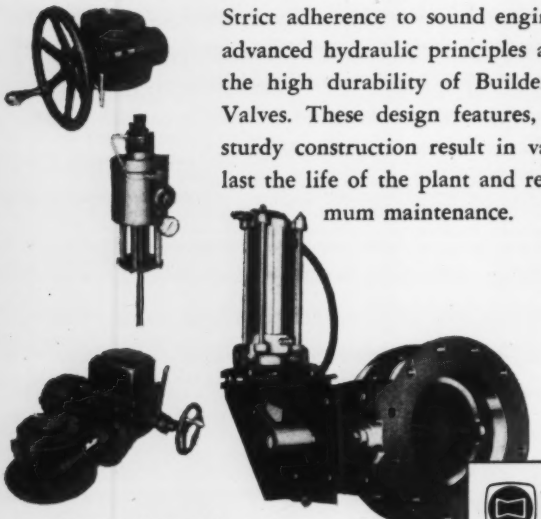

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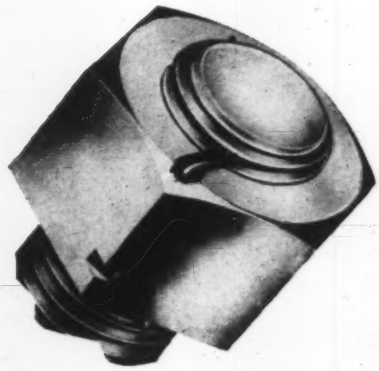

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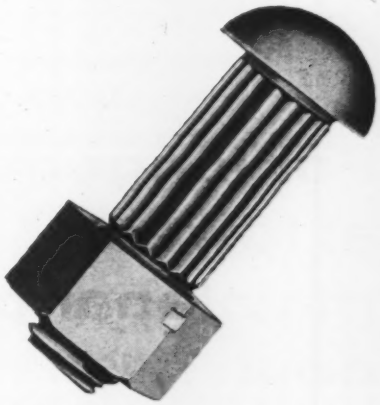

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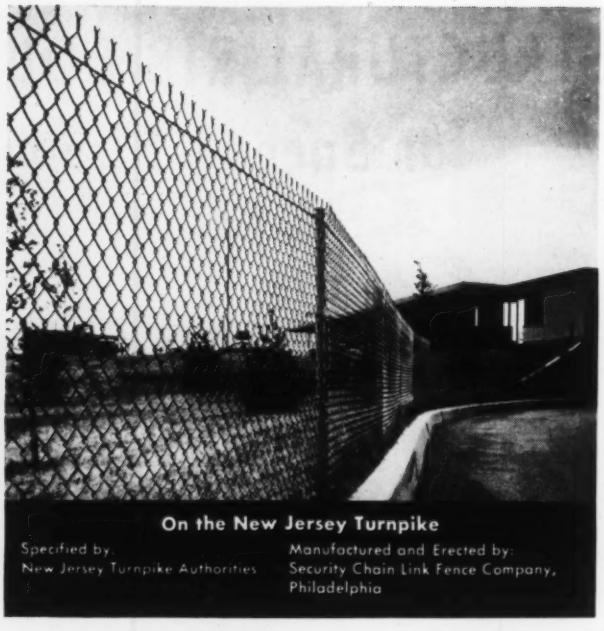

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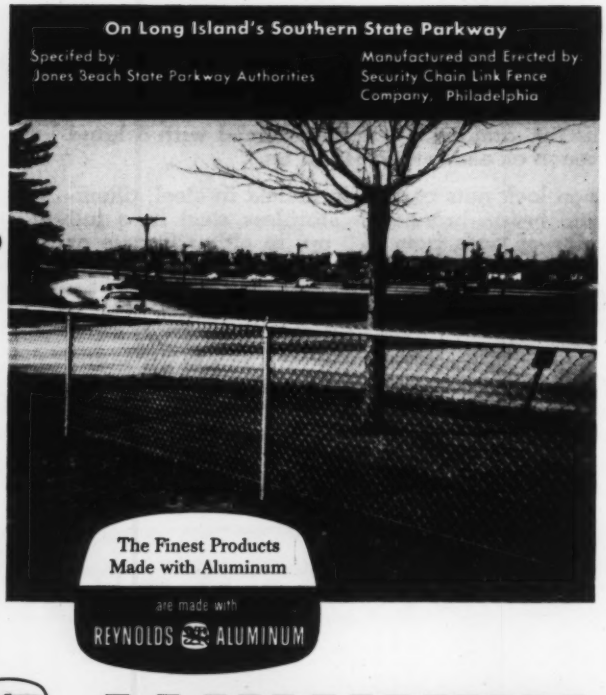
For longer life at lowest maintenance cost...

all-aluminum chain link fence

For real economy you can't beat all-aluminum chain link fencing. Absolutely rustproof, this modern fencing requires no protective maintenance, actually costs *less* in the long run because periodic painting is unnecessary. These two installations, both near the sea, underscore the high corrosion resistance that means long-lasting strength. Some 8,000 feet of 4′ high aluminum fencing has been erected on the New Jersey Turnpike and 70,000 feet on the Southern State Parkway...15 miles of *proof* of good service, long life and economy.

For four-color brochure containing application and specification information on all-aluminum chain link fence and other aluminum highway products, call the nearest Reynolds Sales Office listed under "Aluminum" in classified phone books. Or write to

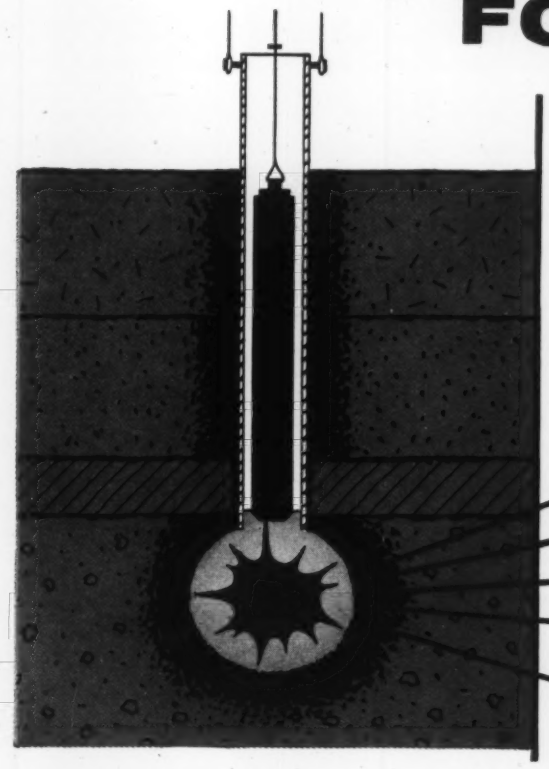
Reynolds Metals Company,
General Sales Office, Louisville 1, Kentucky.


On Long Island's Southern State Parkway
Specified by:
Jones Beach State Parkway Authorities
Manufactured and Erected by:
Security Chain Link Fence Company, Philadelphia
The Finest Products Made with Aluminum
are made with
REYNOLDS ALUMINUM

REYNOLDS ALUMINUM

Watch Reynolds all-family television program "Disneyland", ABC-TV.

FRANKI FOUNDATIONS



UNIQUE INSTALLATION METHOD

CREATES

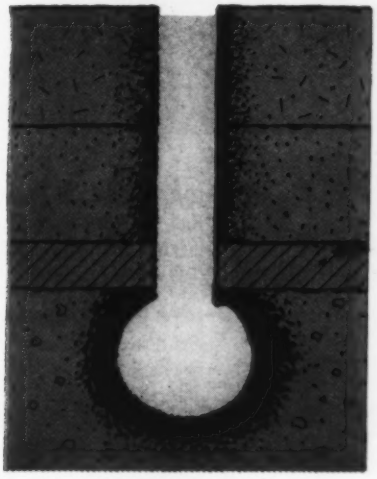
PRESSURE INJECTED FOOTINGS!

compare these advantages with ordinary concrete footings:

- **ZERO SLUMP, "POUNDED IN"** concrete
- **FORGED** by 150,000 FT. LB. blows
- **EXPANDED BASES**—36" to 60" diameter
- **BEARING IN DEPTH** in granular soil or on rock
- **GUARANTEED** to support specified design loads

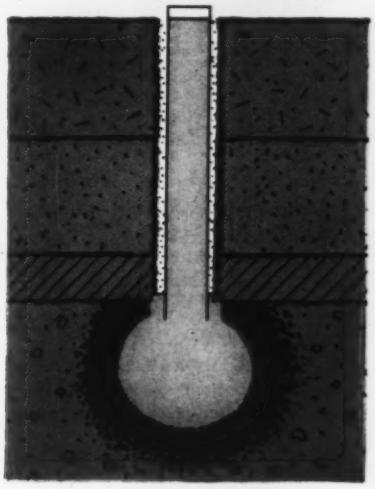
After completion of the pressure injected footing, these two options are available:

UNcased Shaft



Knitting Machinery Plant
Laconia, New Hampshire
Scott & Williams, Inc. — Owner
Austin & Warner — Consult. Eng'r.

Cased Shaft



Vitrified Addition Building
Westboro, Massachusetts
Bay State Abrasive Products Co., — Owner and Structural Engineer

For brochure describing Franki Foundation methods, write to:

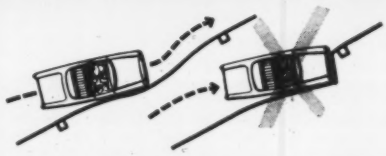
FRANKI FOUNDATION COMPANY 103 PARK AVENUE, NEW YORK 17, N. Y.

AVAILABLE NOW! Granco Steel Products Company, leading building-products manufacturer in the Midwest, introduces new deep-beam Guard Rail for highways and bridges—available through distributors in principal cities.

HI-STRENGTH VISUAL BARRIER. Tough carbon steel. Corrugated shape. Acts as a continuous impact-resistant beam. Highways—12-gage; bridges—10-gage. Force of collision is absorbed by posts on *both* sides of the impact. Highly visible, reflects light day and night.

GREATER SAFETY. Granco Guard Rail reduces highway hazards, minimizes serious accidents and road "hogging," inspires driver confidence, channels out-of-control vehicles back onto road with least damage, lessens danger to other cars.

NO POCKETING! Guard Rail deflects cars *parallel* to roadway, can't trap them in a collapsing pocket (see drawing).



Beam strength and height prevent cars from hurtling over or going under rail. Flared end sections help prevent cars from hitting the end of a rail head on.

INTERCHANGEABLE SECTIONS. Standardized units have been adopted by American Association of State Highway Officials. Damaged sections do not impair efficiency of undamaged sections, may be rolled out and re-used.

ECONOMICAL. Sections nest conveniently for compact shipment, are easy to handle and install. Accessories are furnished with rail. Granco Guard Rail is painted with a rust-inhibitive primer, uniformly applied by "flow coating" and then baked to a hard-enamel finish.

IDEAL FOR BRIDGES. Granco Guard Rail provides a safe approach, permits maximum use of roadway, reduces center-line crowding, protects trusses.

NEW PRODUCT MANUAL! Contains eight pages of application photographs, standard drawings, specifications, curving data, installation instructions and facts on non-highway use. WRITE FOR YOUR FREE COPY TODAY. Attn.: Dept. CI-72.

GRANCO — SINCE GRANITE CITY STEEL 1878

GRANCO® STEEL PRODUCTS CO.

A Subsidiary of GRANITE CITY STEEL COMPANY
6506 N. Broadway, St. Louis 15, Missouri
Executive Offices: Granite City, Illinois

DISTRICT OFFICES: St. Louis • Kansas City • Cincinnati
Dallas • Houston • Chicago • Minneapolis • Atlanta
San Francisco

THE RED CIRCLES INDICATE STRUCTURES BUILT ON RAYMOND FOUNDATIONS

Photo by Fairchild Aerial Surveys, Inc.

In Boston . . .
81
STRUCTURES
REST ON
RAYMOND
FOUNDATIONS

As you can see, this section of historic, venerable Boston between Fenway Park . . . a part of which is shown in the foreground . . . and the Harbor is liberally sprinkled with Raymond-supported structures. But this is only a small segment of the foundation contracts we have completed in this home of tradition, thumping Ted Williams and the Red Sox. For example, the John Hancock Mutual Life Insurance Company Building, Mystic River Bridge, new John Fitzgerald Expressway, Boston Museum of Science, the administration building and control tower at Logan International Airport are just a few of Boston's more familiar landmarks built on Raymond piles.

What you see here is equally evident in other major cities across the country. Wherever you travel, you are almost certain to visit or see a Raymond-supported structure. May we apply this experience and knowledge to your next foundation or heavy construction project?

FOUNDATIONS FOR THE STRUCTURES OF AMERICA

COMPLETE CONSTRUCTION SERVICES ABROAD

RAYMOND

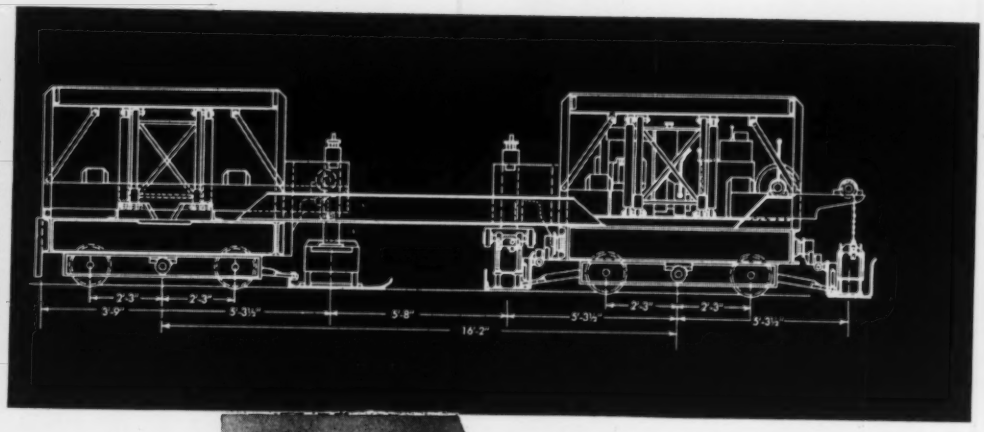
CONCRETE PILE CO.

140 Cedar Street, New York 6, N.Y.

Branch Offices in Principal Cities of the United States. Subsidiaries in Canada, Latin America and other countries throughout the world.

You are cordially invited to send for our new Highway Brochure, which gives a detailed resume of how Raymond can help you and the National Highway Program. Just write Dept. C-10, Raymond Concrete Pile Co., 140 Cedar Street, New York 6, N. Y.

Two Detroit Special finishing machine frames engineered into one rugged unit combining finisher and float operation. Equipped with quick crown change screeds. Supplied in either 12' to 18' or 20' to 25' working widths. Hydraulically controlled pneumatic tired transportation assemblies optional.

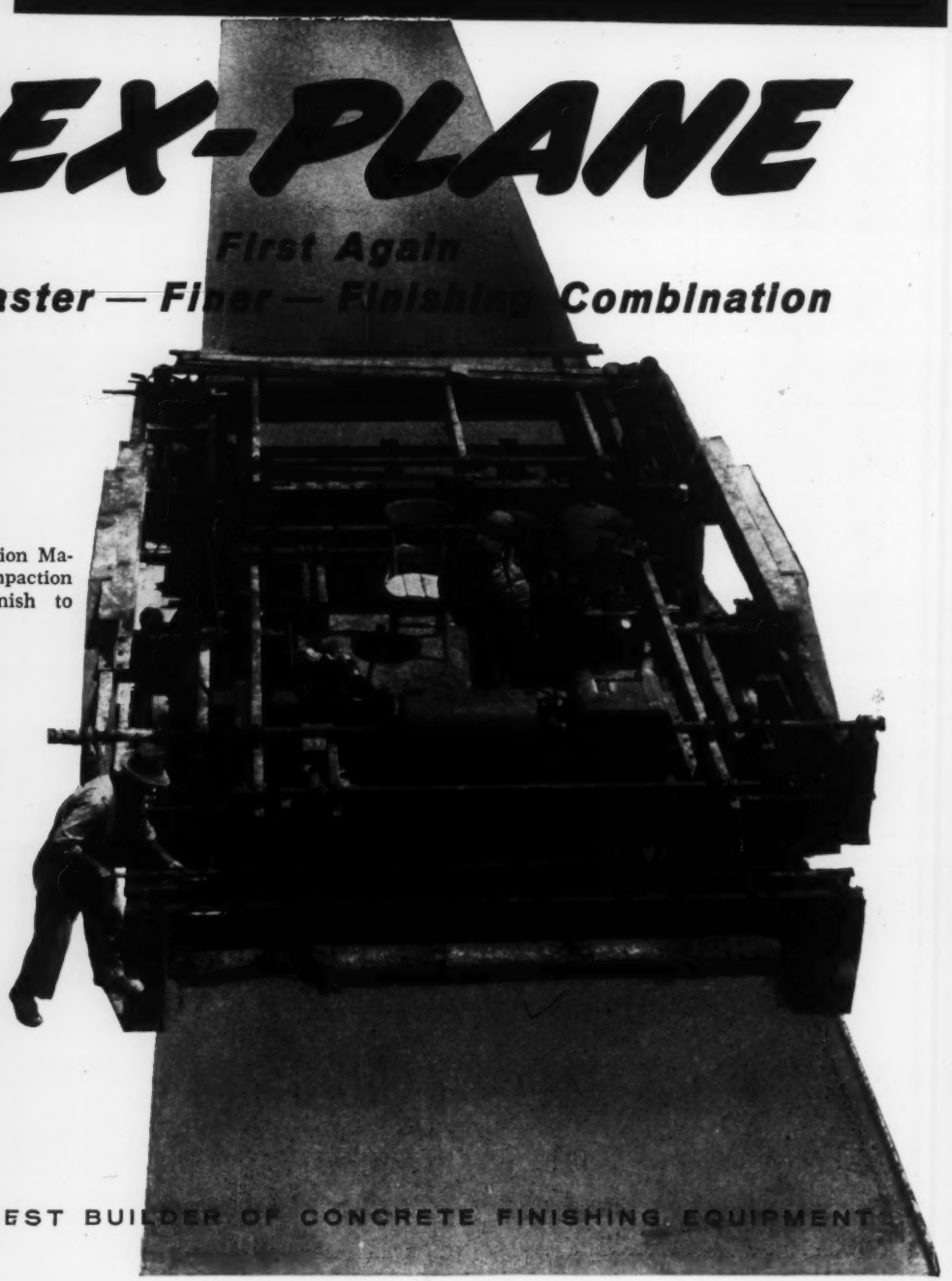


FLEX-PLANE

First Again

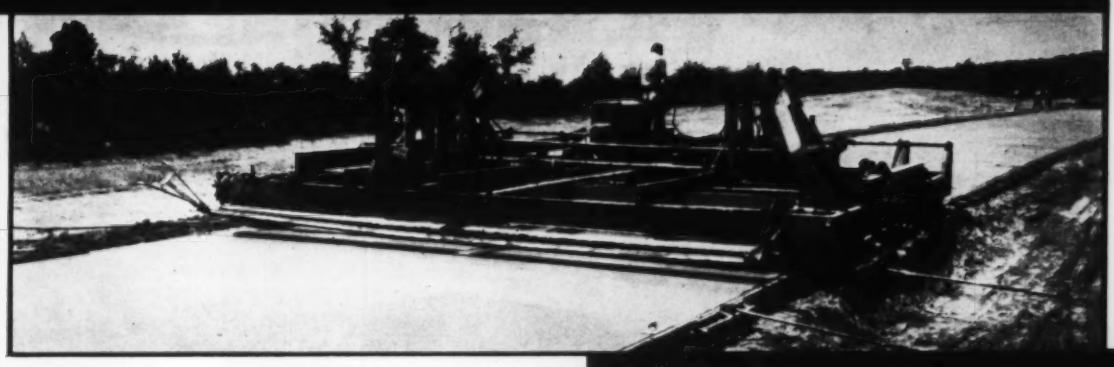
with Faster — Finer — Finishing Combination

"FLEX-PLANE" Combination Machine gives greater compaction and applies superior finish to Connecticut Turnpike.



WORLD'S LARGEST BUILDER OF CONCRETE FINISHING EQUIPMENT

U. S. ROUTE 16—near Farmington, Michigan. Loselle Construction's Combination increases daily finishing average.



". . . 4400 feet of 22-foot pavement finished in one day." . . . "keeps up with three dual drum pavers." . . . "450 lineal feet of 24′ pavement per hour." These are typical reports from contractors using the revolutionary new Flex-Plane Combination Finisher-Float Machine which does the combined jobs of transverse and longitudinal finishers. On the average, users finish over 3000 feet of pavement a day, requiring only two or three hand finishers depending on type of joints being used.

On-the-job checks show longitudinal surface smoothness to be unsurpassed by any other equipment regardless of condition of forms. Results prove it to be the fastest, most efficient finishing machine in use today.

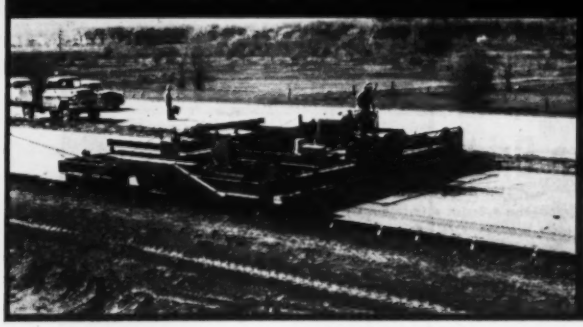
But why not get all the facts? Write today for your copy of the data-packed "Flex-Plane Finisher-Float Machine" brochure. See for yourself why contractors consider it the finest machine of its type in the world.

368

U. S. ROUTE 30 — J. A. Jones Construction Company uses combination on straightaway paving — Flexplane self-widener on interchanges near Mansfield, Ohio.

CONNECTICUT TURNPIKE—DeLillo Construction Company's Combination cuts hand finishing to a minimum.

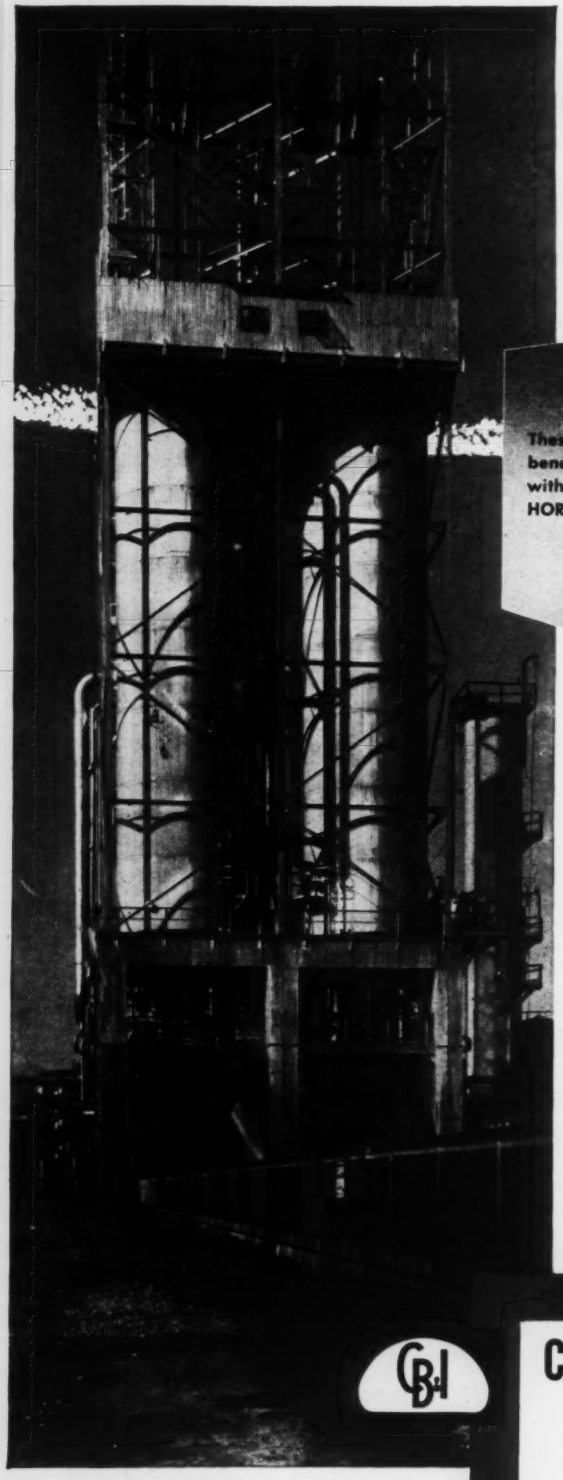
U. S. ROUTE 12—Kalamazoo, Mich., bypass is worked by Carl Goodwin & Sons. Contractors generally report substantial savings over previous finishing methods.



U. S. ROUTE 23—Combination Machine owned by Denton Construction Company keeps up with three dual drum pavers south of Brighton, Michigan.

THE FLEXIBLE ROAD JOINT MACHINE COMPANY

532 THOMAS RD., WARREN, OHIO



HORTONCLAD®

(manufactured by vacuum bonding process)

provides better corrosion protection in clad vessels

These benefits with HORTONCLAD®...

- UNIFORM THICKNESS
- HIGH STRENGTH BOND
- CLEAN, CONTAMINANT–FREE SURFACE
- ADAPTABILITY TO ANY SIZE OR SHAPE

Hortonclad, available only in CB&I tanks, pressure vessels and other clad structures, is unlike other clad materials. The bond is accomplished by a flux-free high strength vacuum bonding process producing a clad plate with an integral and continuous bond of exceptionally high strength. Uniform clad thickness results as both alloy cladding and backing are in their final thickness *before* bonding. Silver, stainless steels (both chromium and chromium nickel) nickel and high nickel alloys such as Monel, Inconel, and Hastelloys B and F can be employed in the Hortonclad process.

In corrosive service, Hortonclad permits the use of higher temperatures, concentration and pressures—without the high cost of solid alloy vessels. For further information on its application write our nearest office . . . ask for the *Hortonclad* bulletin.

405 STAINLESS STEEL HORTONCLAD was used in the fabrication of these two 16-ft. diam. by 65-ft. high coking chambers by CB&I.

P52

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.
REPRESENTATIVES AND LICENSEES:
Australia, Cuba, England, France, Germany, Italy, Japan, Netherlands, Scotland
SUBSIDIARIES:
Horton Steel Works Limited, Toronto; Chicago Bridge & Iron Company Ltd., Caracas; Chicago Bridge Limited, London; Sociedade Chibridge de Construcoes Ltda., Rio de Janeiro.

The Low-Down on Low-Bowl Scrapers

A wide, low bowl is important in a scraper, but it takes more than just low-bowl design to give you performance with the best profit factor.

That's why Allis-Chalmers combines this with other equally important features to give you the most efficient scrapers available.

CHECK THIS PROFIT-BUILDING COMBINATION:

1.

Low, wide-bowl design for fast, heaped loading.

2.

Curved bowl bottom and offset cutting edge for faster, easier penetration and live, boiling loads that fill every corner of bowl.

3.

Patented apron-ejector linkage combines high apron lift with positive, forward forced ejection—permits either quick, complete dump or smooth, even spreading.

Your Allis-Chalmers dealer will be glad to discuss these and many other profitable advantages with you. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

simplicity

"IT'S SHORE WONDERFUL . . . EVEN
COUSIN FOOLEY KIN PUT IT TOGETHER."

U.S. PIPE FOR WATER, SEWERAGE AND

itself

Our new "Tyton Joint" pipe assembles so easily even an inexperienced crew can master the technique quickly.

Only one accessory needed...a specially designed rubber gasket which seats in the bell. The entering pipe slides into place easily, compressing the gasket... making a tight, permanent seal.

No bell holes needed. What's more, "Tyton Joint" doesn't mind wet feet. You can lay it in the rain if need be!

Like to know more about this revolutionary, new pipe joint that saves time and trouble in the trench...and money on your contract?

Write or call today for the facts on "Tyton."

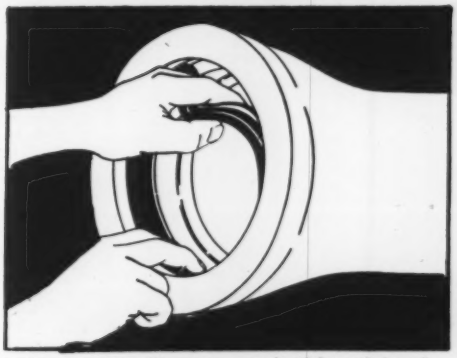
U. S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE

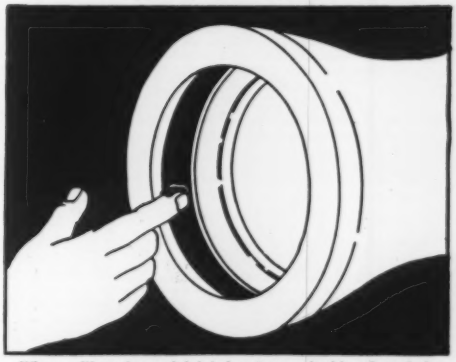
INDUSTRIAL SERVICE CAST IRON

TYTON

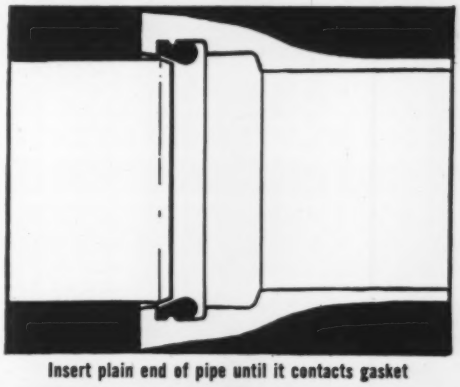
ONLY FOUR SIMPLE ACTIONS



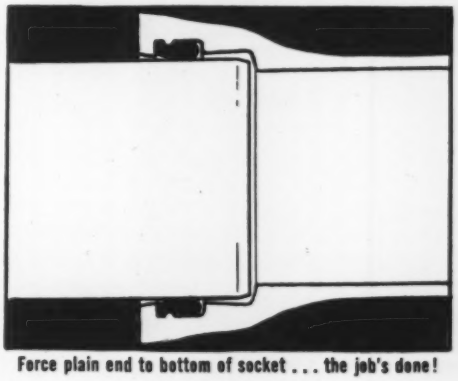
Insert gasket with groove over bead in gasket seat



Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket . . . the job's done!

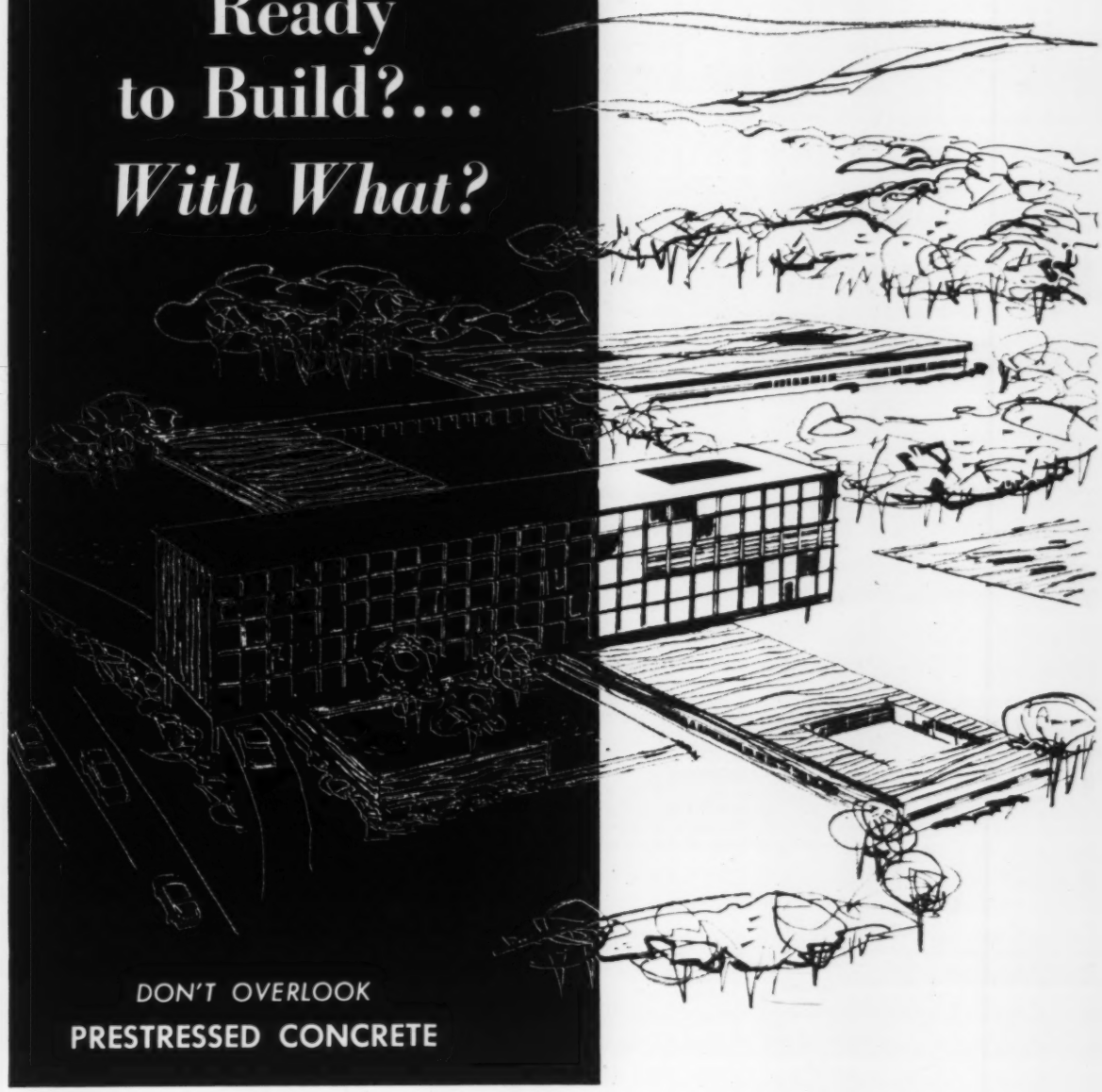
Deep Underpinning
by
SPENCER, WHITE & PRENTIS, INC.

extending 60 ft. to rock overlain by water-bearing sand

Project:
Court House Square Development, Denver, Colo.
Contractor:
Webb & Knapp Construction Co.
Consulting Engineers:
Moran, Proctor, Mueser & Rutledge

Spencer, White & Prentis, Inc., 10 East 40th St., New York 16, N. Y. • Detroit • Chicago • Washington • Canada

Ready to Build?... *With What?*



DON'T OVERLOOK
PRESTRESSED CONCRETE

Today, structures of virtually every description are being built of prestressed concrete (not to be confused with reinforced concrete). Garages, schools, office buildings, factories, warehouses, hospitals and motels, highway bridges and piers are typical examples of this increasingly popular building material.

Most prestressed concrete structures employ precast pretensioned members in which high-strength steel strands are stretched in forms before the concrete is poured around them. After sufficient curing to bond the concrete to the strands, the tension is gradually released.

Construction speed, structural balance, permanence, insurance benefits and economies in maintenance and design are just a few of the advantages that are realized in prestressed structures—factors to be considered in any proposed building.

Roebling, as a pioneer in the development of prestressing elements and techniques in the United States, is in a position to furnish you with complete information and assistance on any matter concerning prestressing methods, applications and materials. Write Construction Materials Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

Consult Roebling—First in the U. S. with prestressing and tensioning elements

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Architect:
ZIEGLER,
CHILDS & PAULSEN
Jersey City

Contractor:
WALTER KIDDE
CONSTRUCTORS, INC.
New York & Houston

17 stories of quality masonry construction—with LEHIGH MORTAR CEMENT

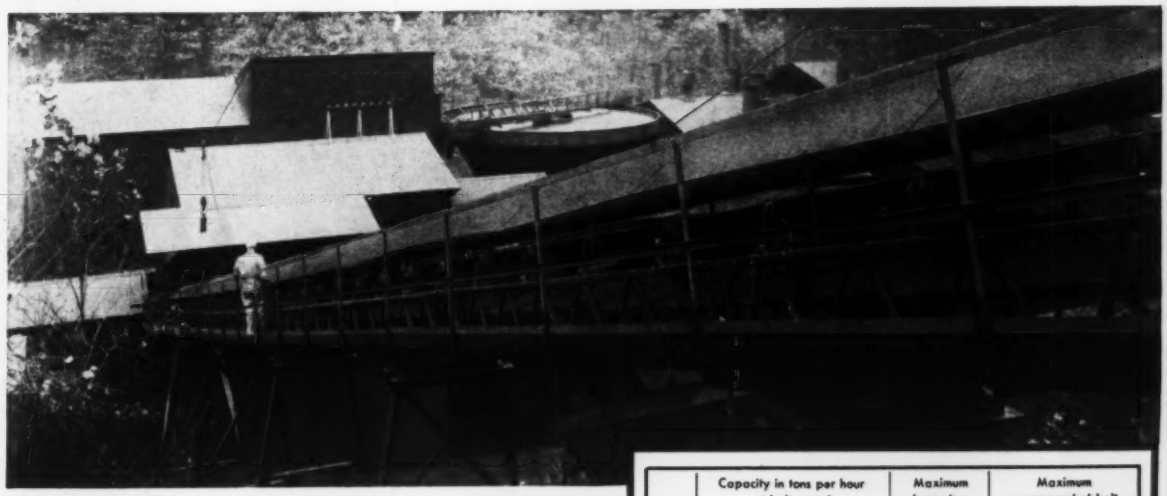
Over 5,000 barrels of Lehigh Mortar Cement were used in the masonry of this new 17-story $13,000,000 Martland Medical Center, overlooking Newark, New Jersey.

Walter Kidde Constructors, Inc. selected Lehigh Mortar Cement for its uniformity and ease of handling which permitted a smooth running masonry operation, kept labor costs down, and contributed to quality workmanship.

Try Lehigh Mortar Cement on your next job. See for yourself how it encourages good workmanship—helps produce clean, weathertight masonry walls.

LEHIGH PORTLAND CEMENT COMPANY
Allentown, Pa.

• LEHIGH MORTAR CEMENT • LEHIGH PORTLAND CEMENT • LEHIGH EARLY STRENGTH CEMENT • LEHIGH AIR-ENTRAINING CEMENT

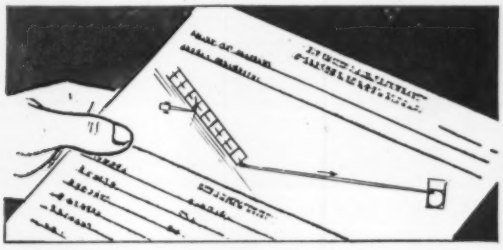


For lower costs down the line
make your belt conveyors

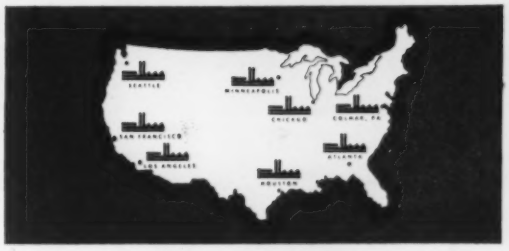
PRE-BILT by LINK-BELT

Belt width, inches	Capacity in tons per hour at belt speed of 100 FPM			Maximum lump size, inches		Maximum recommended belt speed, FPM	
	Weight of material, lbs. per cu.ft.			Sized	Unsized	Half maximum size lumps	Maximum size lumps
	50	75	100				
18	27	40.5	54	3	5	400	300
24	50	75.0	100	4½	8	500	400
30	81	121.5	162	7	10	600	450
36	117	176.0	235	8	14	650	500

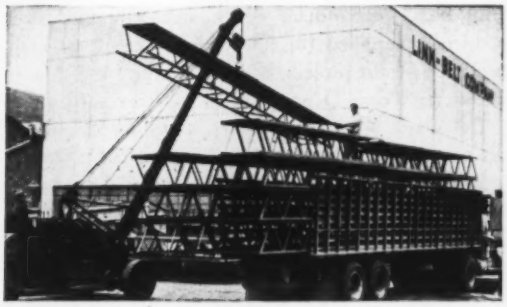
EASY SELECTION. Your Link-Belt engineer will help you choose the best combination from a wide selection of PRE-BILT sectional belt conveyor components.



PROMPT ESTIMATES. From standardized data, an "on-the-site" quotation can be prepared covering the components for your needs.



SPEEDY DELIVERY. Standardized parts are shipped from the nearest of 8 plants. One-source availability eliminates the delay of coordinating purchases from several suppliers.



FAST INSTALLATION. Due to simple construction and shop-assembled components, you can do your own erecting. Link-Belt also furnishes complete erection service and supervision.

Link-Belt PRE-BILT sectional belt conveyors combine operating efficiency and economy to give you years of dependable, profitable operation.

For full information on these durable conveyors up to 36 in. wide—with drives up to 40 hp, 24 and 42-inch truss depths—contact your nearby Link-Belt office, or send for Book 2579.

LINK-BELT

BELT CONVEYORS

14,702

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

From left: W. C. Lathrop, Senior Civil Engineer; L. L. Halladay, Waterworks Engineer; C. R. Liese, Senior Civil Engineer—Water Works Dept., Minneapolis

Temperatures from 32° below to 100° above haven't hurt this tar-enameled steel pipe

Here in Minneapolis two long spans of exposed steel pipe have been subjected to a 132-deg temperature range for the last eight years. But despite frigid winter spells down to 32 deg below and scorching, 100-deg summer days, the pipe has functioned perfectly.

The 48-in. ID main shown above extends 837 ft across the Mississippi River cradled under the Franklin Avenue bridge. The pipe was coal-tar enameled inside and out and has no other protection. It was supplied by Bethlehem in 40-ft lengths joined by butt-welding. The pipe rests on rollers to permit movements due to expansion and contraction, but expansion joints were not required.

The river crossing is a small portion of the city's 19.5-mi "Big Inch" water main which was completed in 1949. Bethlehem supplied 102,500 ft of 48 x ⅜-in. tar-enameled steel pipe for the project. It was laid, with welded joints, by the Water Works Department of the City of Minneapolis.

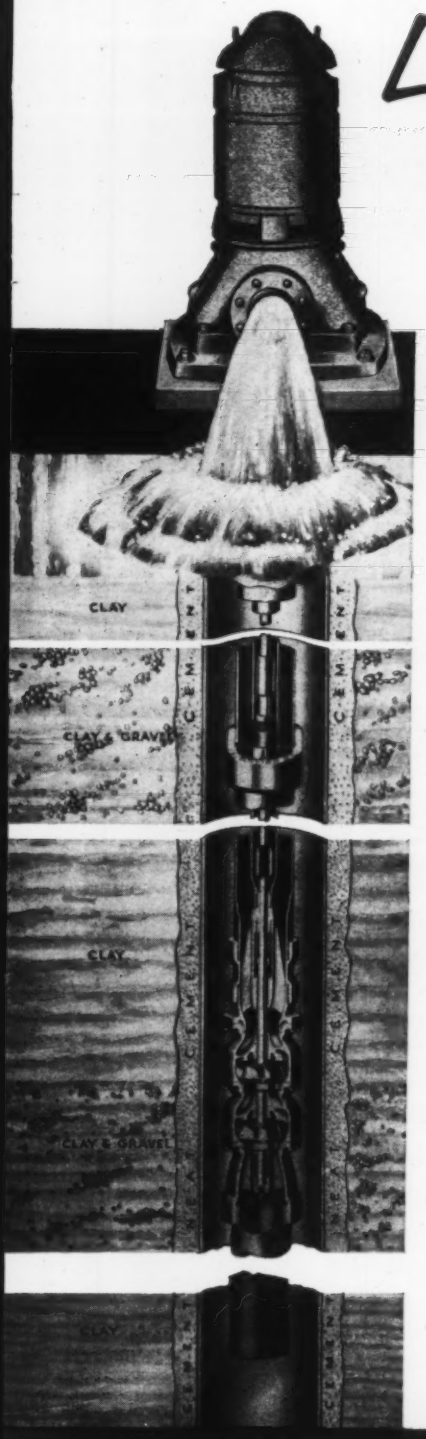
The Water Works Department states that the entire line has given outstanding service. The fact that no leakage or loss of flow has been reported indicates that the interior lining is in excellent condition. Visual inspection has not disclosed any impairment to the pipe coating.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Layne knows more about water bearing formations!



On whose say-so? Not on ours—but on the experience of scores of American and foreign firms and municipalities whose very existence and success depend on an adequate supply of water.

Knowing where the water is — and then tapping the subterranean source is but a part of the vast knowledge the Layne organizations have accumulated in three quarters of a century.

Once the source is determined and the water supply developed, a dependable means for delivering the water must be provided, and that's where the famous Layne pump comes in. For each Layne pump is specifically engineered for the particular job. There is no "stock" Layne pump. Your pump is created for your job —making use of the knowledge of strata, water requirements and usage.

ENGINEERED, DEPENDABLE PERFORMANCE IS WHAT YOU GET WHEN LAYNE DOES THE JOB— COMPLETE FROM WATER LOCATION TO YEAR AFTER YEAR OF TROUBLE-FREE PUMPING.

YOUR NEXT WELL AND PUMP INSTALLATION MAY BE MONTHS OFF. GET TO KNOW THE LAYNE FOLKS IN YOUR AREA. SAVE TIME AND MONEY THROUGH THEIR INTIMATE KNOWLEDGE OF WATER.

Send now for our general services bulletin No. 100.

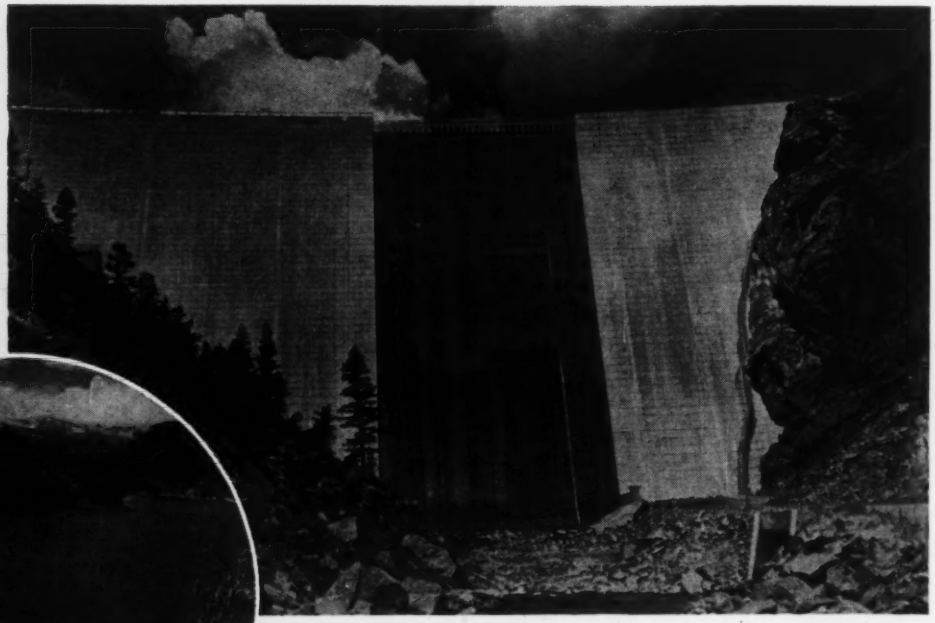
1882 — 1957
Layne
75 YEARS OF PROGRESS

WATER WELLS • VERTICAL TURBINE PUMPS • WATER TREATMENT

LAYNE & BOWLER, INC. MEMPHIS

General Offices and Factory • Memphis 8, Tennessee

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD



Gross Dam and Reservoir, an integral part of Denver's vital water storage.

Expandable Gross Dam Stores Denver Water

Gross Dam is an excellent example of the versatility of concrete in making possible the expansion of present structures for future needs.

It is 340 feet high—stores 42,000 acre-feet of water, or approximately one-sixth of Denver's total water storage capacity. This water from the melting snows of winter and summer rainfall on Denver's Rocky Mountain watersheds provides the essential year-round water supply needed for a city of three quarters of a million people.

625,000 cubic yards of concrete were used in the present dam structure. For the future, the dam can be enlarged by increasing its height 120 feet to 460 feet, and its thickness. To do this, the present reservoir need not be de-watered, as the thickening and raising of the dam would be accomplished on the outside face. Total capacity of the enlarged dam would nearly triple present reservoir storage to 113,000 acre-feet of water.

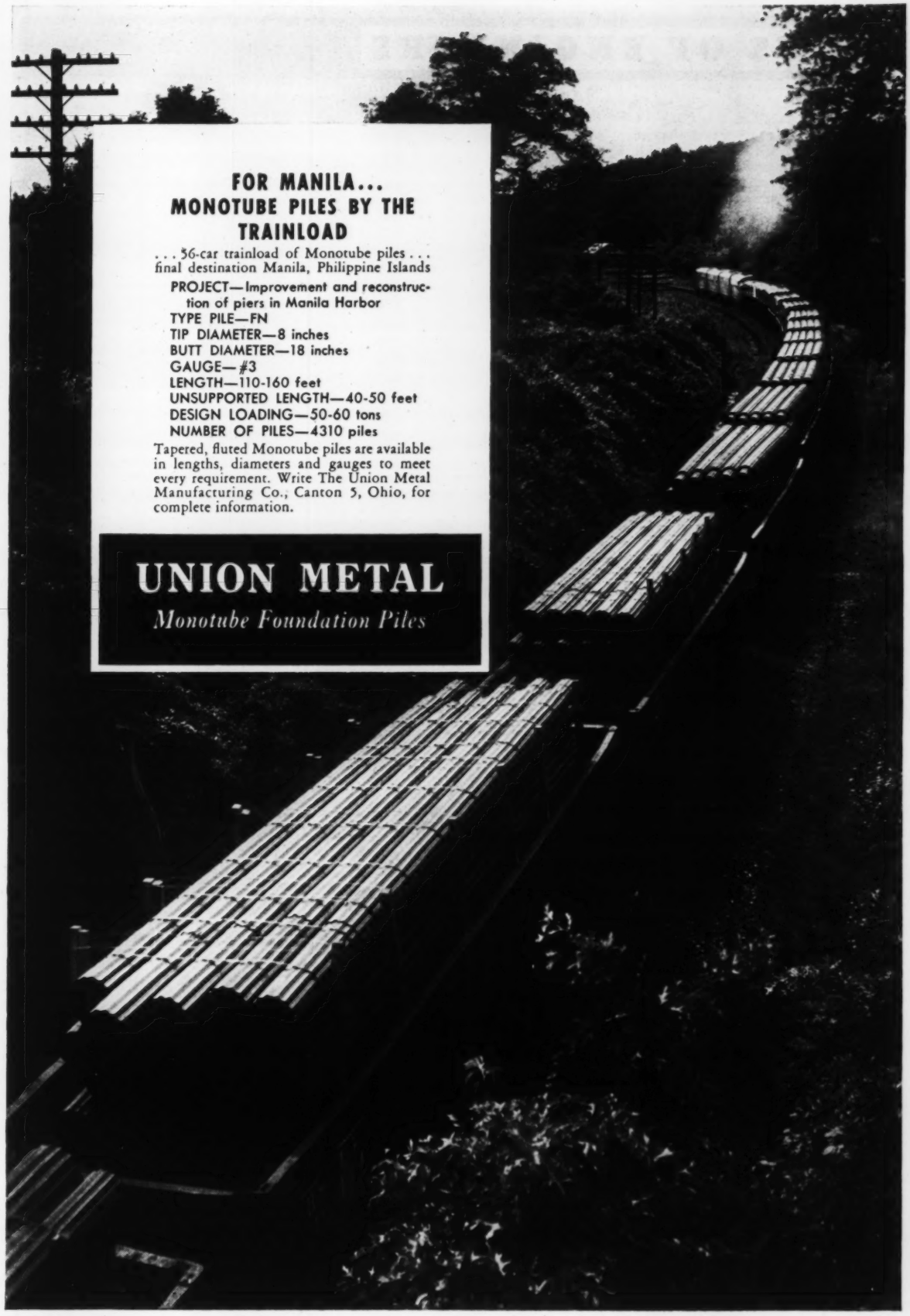
Today's dam answers today's needs for water. Tomorrow's expanded structure is an excellent demonstration of the versatility of concrete in solving a difficult construction problem. Gross Dam is built 100% of Ideal Cement concrete.

PORTLAND IDEAL CEMENT

IDEAL CEMENT COMPANY

DENVER, COLORADO

14 Plants and 2 Terminals Serving
Some of the Most Rapidly Growing Areas of the Nation


FOR MANILA...
MONOTUBE PILES BY THE
TRAINLOAD
. . . 56-car trainload of Monotube piles . . .
final destination Manila, Philippine Islands
PROJECT—Improvement and reconstruction of piers in Manila Harbor
TYPE PILE—FN
TIP DIAMETER—8 inches
BUTT DIAMETER—18 inches
GAUGE—#3
LENGTH—110-160 feet
UNSUPPORTED LENGTH—40-50 feet
DESIGN LOADING—50-60 tons
NUMBER OF PILES—4310 piles
Tapered, fluted Monotube piles are available in lengths, diameters and gauges to meet every requirement. Write The Union Metal Manufacturing Co., Canton 5, Ohio, for complete information.
UNION METAL
Monotube Foundation Piles

NEWS OF ENGINEERS

Edmund H. Lang, Colonel, Corps of Engineers, has been appointed district engineer of the U. S. Lake Survey, with headquarters in Detroit. Colonel Lang goes to Detroit from the Army War College at Carlisle Barracks, Pa. He has represented the United States on various international boards and committees pertaining to the Great Lakes and the St. Lawrence River.

Colonel Lang

James A. Mandigo has been appointed representative in the engineering development of airports and related facilities by the J. E. Greiner Company, Baltimore consulting engineers. Prior to his association with the firm, Mr. Mandigo was director of facilities for Trans World Airlines passenger service department.

David A. Kosh Associates, Public Utility Consultants, announce the removal of their offices to 1757 K Street, N. W., Washington, D. C.

Almon H. Fuller, professor, author and structural designer, has retired from the faculty of Iowa State College after teaching engineering for 60 years. Professor Fuller has been professor of civil engineering and dean of the College of Engineering at the University of Washington; professor and head of the civil engineering department at Lafayette College; and head of the department of civil engineering at Iowa State College. He was made an honorary Doctor of Engineering by Iowa State in 1955 and was honored as professor emeritus of civil engineering by the Iowa Board of Regents in July 1957. Professor Fuller now lives at Wesley Gardens, Des Moines, Wash.

William F. Cassidy, Brigadier General, division engineer for the Army's South Pacific Division, Corps of Engineers, has been named a member of the Board of Engineers for Rivers and Harbors. General Cassidy was recently elected chairman of the Pacific Southwest Inter-Agency Committee and appointed to membership on the United States Committee of the International Commission on Large Dams. He has been division engineer since 1955.

S. P. McCasland, formerly chief hydraulic engineer with Sanderson & Porter, New York City, has been appointed chief hydroelectric engineer of Ebasco International Corporation in the same city. The firm is a subsidiary of American & Foreign Power, and renders engineering service to the 45 systems of that group in Latin America and Asia.

Roy H. Christ, sales manager for the Weaver Iron Works, Inc., Dallas, Tex., has been appointed vice-president in charge of sales for the firm.

Hugh A. Shamberger, since 1951 Nevada State Engineer, has been appointed director of Nevada's newly created Department of Conservation and Natural Resources. Mr. Shamberger has served the state government since 1933. In his new post, Mr. Shamberger will have broad authority over the State's lands, water resources, forestry, and oil and gas, and will assist in matters pertaining to interstate waters.

H. A. Shamberger

Edo's new Model 400 Stratagraph records strata formations underlying the beds of rivers, lakes and any other relatively shallow body of water, with sharp definition and complete accuracy.

Sediment, intermediate layers, bed rock and faults are all readily distinguished and pictorially shown on the Stratagraph's electrosensitive paper, with an accuracy in depth indication of one-half of one per cent.

The Edo Stratagraph is currently in use in various parts of the world to determine quickly and positively the layers at which foundations can be set. It effects great savings in time and money over older core boring and seismic methods of strata determination.

The Stratagraph's narrow beamwidth is achieved by means of a cone-shaped transducer and results in exceptional depth and layer definition. The Stratagraph makes permanent recordings in eight overlapping range scales:

0-70 feet or fathoms
60-130 feet or fathoms
120-190 feet or fathoms
180-250 feet or fathoms

For complete details write to:

Edo CORPORATION, College Point, L. I., N. Y.

Visit Edo's ASCE Booth #3 to inspect Stratagraph and other fine Edo electronic equipment.

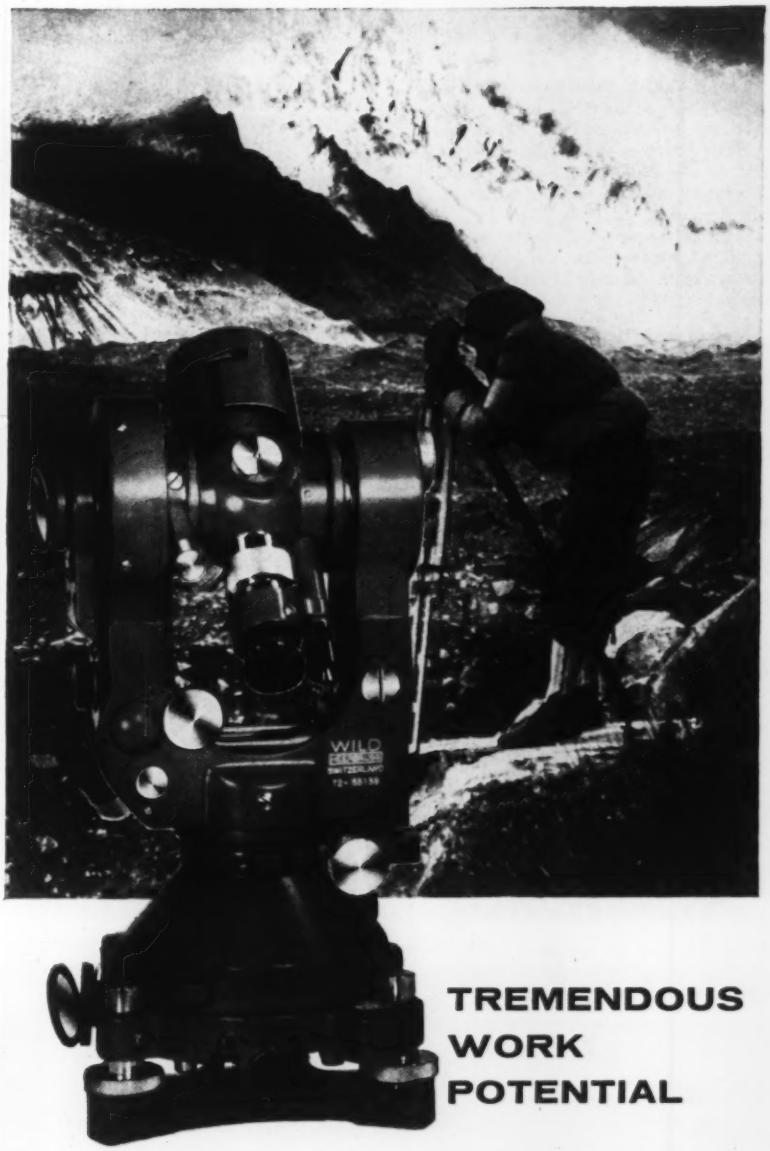
Thomas Blench, professor of civil engineering at the University of Alberta and consulting engineer at Edmonton, Canada, has just returned from the Seventh Congress of the International Association for Hydraulic Research in Lisbon, Portugal. While there, Mr. Blench delivered a paper on "Unification of Flow Formulas." Mr. Blench is also author of a new book, entitled *Regime Behavior of Canals and Rivers.*

Tippetts-Abbett-McCarthy-Stratton, consulting engineers of New York City, announce the admission of **Barnett Silveston** as general partner, and **Eugene E. Halmos** and **Wilson V. Binger** as associate partners. Mr. Silveston has been with the firm since 1943 as associate partner in charge of port and harbor engineering. Mr. Halmos joined the firm in 1948 and has since served it as chief design consultant. Mr. Binger, manager of the firm's operations in Venezuela, Colombia, Ecuador, and Central America for the past three years, has been connected with the firm since 1952.

Lawrence F. Whearty is in Baghdad, Iraq, with the International Cooperation Administration, assigned to the Flood Control and Irrigation Section of its Development Board. He has just returned from a brief trip to Amman, Jordan, where he acted as engineering adviser to the government. Mr. Whearty was formerly chief of the Administrative Engineering Branch, Design & Construction Division of the U. S. Bureau of Reclamation in Montana.

Shown here are some of personnel of TESTlab, a new corporation for the manufacture and marketing of apparatus and equipment for laboratory and field engineering testing of soils and bituminous and concrete materials. Witnessing a triaxial test are John P. Gnaedinger, (left), J. M. ASCE, one of the consultants for the new venture, and M. D. Morris, A. M. ASCE, vice-president in charge of engineering and sales. Headquarters for the new company is Chicago, and there are regional offices in New York and San Francisco.

(Continued on page 30)



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The Wild T-2 enables the operator to work rapidly, precisely and steadily under conditions that may range from equatorial to antarctic.

Optical and mechanical excellence, plus negligible maintenance requirements, combine with a complete list of accessories to make the T-2 the finest instrument in its class by far.

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News of Engineers

(Continued from page 29)

Thein Wah, assistant professor of civil engineering at the University of Connecticut, has assumed duties as senior research engineer for the structures section of the Department of Engineering Mechanics at the Southwest Research Institute, San Antonio, Tex. Dr. Wah taught at Lehigh University and has been a designer in the Bureau of Bridges of the Illinois Division of Highways.

Marvin A. Larson has opened an office for the practice of structural engineering at 251 Kearny Street, San Francisco, Calif.

Murray A. Wilson was one of four alumni of Kansas State College receiving distinguished service awards at the college's 33rd annual open house. Mr. Wilson heads the Salina, Kans., engineering firm bearing his name.

C. R. Marks, III, Texas engineer, has joined the staff of Lockwood, Andrews & Newnam, consulting engineers of Victoria, Houston and Corpus Christi. Mr. Marks has designed dams, locks and hydroelectric plants for the Tennessee Valley Authority and the Republic of Turkey. Since 1945, he has been chief design engineer, vice-president and head of the Texas office of Ambursen Engineering Corp.

Charles H. Topping, senior architectural and civil engineering consultant to the engineering department, E. I. du Pont de Nemours & Co., Wilmington, has been elected president of the Building Research Advisory Board, a unit of the National Academy of Sciences-National Research Council.

Donald H. McCoskey, chief of the Engineering Division of the Southwestern Division of the Corps of Engineers at Dallas, Tex., has retired after 28 years of service. In his present position since July 1950, he has been responsible for investigation, studies, design and award of architect-engineer construction contracts on military and civil works projects.

George E. Miller & Associates announce the opening of an office specializing in civil and sanitary engineering. The office will be located at 602 East Market Street, York, Pa.

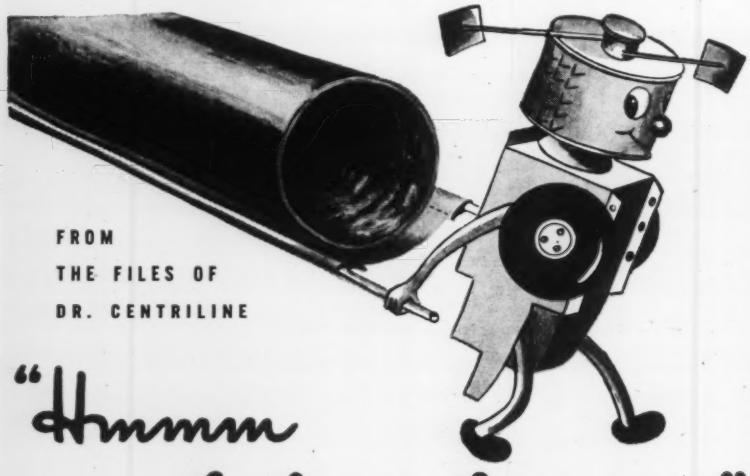
Gordon E. Mau, chief of the Water Pollution Control Section of the Kansas State Board of Health, has joined Ediger & Company of Wichita, Kans., as sanitary engineer. The concern was previously known as the Ediger Engineering Co.

Gene M. Nordby has been appointed program director for engineering sciences of the National Science Foundation, Washington, D. C. Before going to the Foundation a year ago as an engineer, Mr. Nordby was a member of the civil engineering faculty at Purdue University and at the University of Colorado.

Lincoln B. Grayson has joined the Heavy Construction Department of Kaiser Engineers, Oakland, Calif. Mr. Grayson has just returned from Australia where he spent eight years on civil construction work with the Hydro-Electric Commission of Tasmania, the Snowy Mountains Authority and the joint venture of Kaiser-Walsh-Perini-Raymond.

Horace O. Titus, chief bridge designer for the Wyoming Highway Department, has been named new chief design engineer for Gate City Steel, Boise, Idaho. He was previously associated with the American Bridge Company and the South Dakota Highway Commission. Through an inadvertence that is deeply regretted, Mr. Titus' photo was erroneously identified as Leroy C. Smith in the August issue. Our apologies to both.

Horace O. Titus



CASE #7841

PATIENT: 8 Miles of 16" and 12" Cast Iron Water Supply Lines in Abington-Rockland (Mass.) Water District.

SYMPTOMS: Lack of water and pressure during periods of high demand requiring restrictions in the summertime.

DIAGNOSIS: Poor circulation due to regrowth of tuberculation after cleaning. Available water could not be delivered to consumers.

TREATMENT: The lines were cleaned and cement lined in place without interrupting service to consumers. In less than 8 weeks the entire job was completed.

RESULTS: Patient now sound and healthy; pipe capacity permanently doubled, no further summer restrictions, future maintenance costs were eliminated.

If your lines also show signs of suffering from corrosion, leakage or tuberculation, investigate the Centriline Process. Cleaning and cement lining in place has been a successful remedy for over 1,000 miles of water supply pipelines. Centriline hasn't lost a patient yet.

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Branch Offices in Principal Cities of the United States, Canada, and Latin America.

Thomas A. Lane, Brigadier General, U. S. Army, has been assigned command of the U. S. Army Engineer Training Center at Fort Leonard Wood, Mo. General Lane has been engineer commissioner for the District of Columbia since December 1954.

Henry J. Cowan, professor of architectural science at the University of Sydney, Australia, has been awarded the R. W. Chapman Medal by the Institution of Engineers of Australia for a paper entitled, "Torsion in Reinforced and Prestressed Concrete Beams." The medal is awarded annually for a paper of "outstanding character and originality."

Donald A. du Plantier announces the opening of an office for the practice of consulting engineering, concrete or steel bridges and structures, at 1717 West End Building, Nashville 3, Tenn.

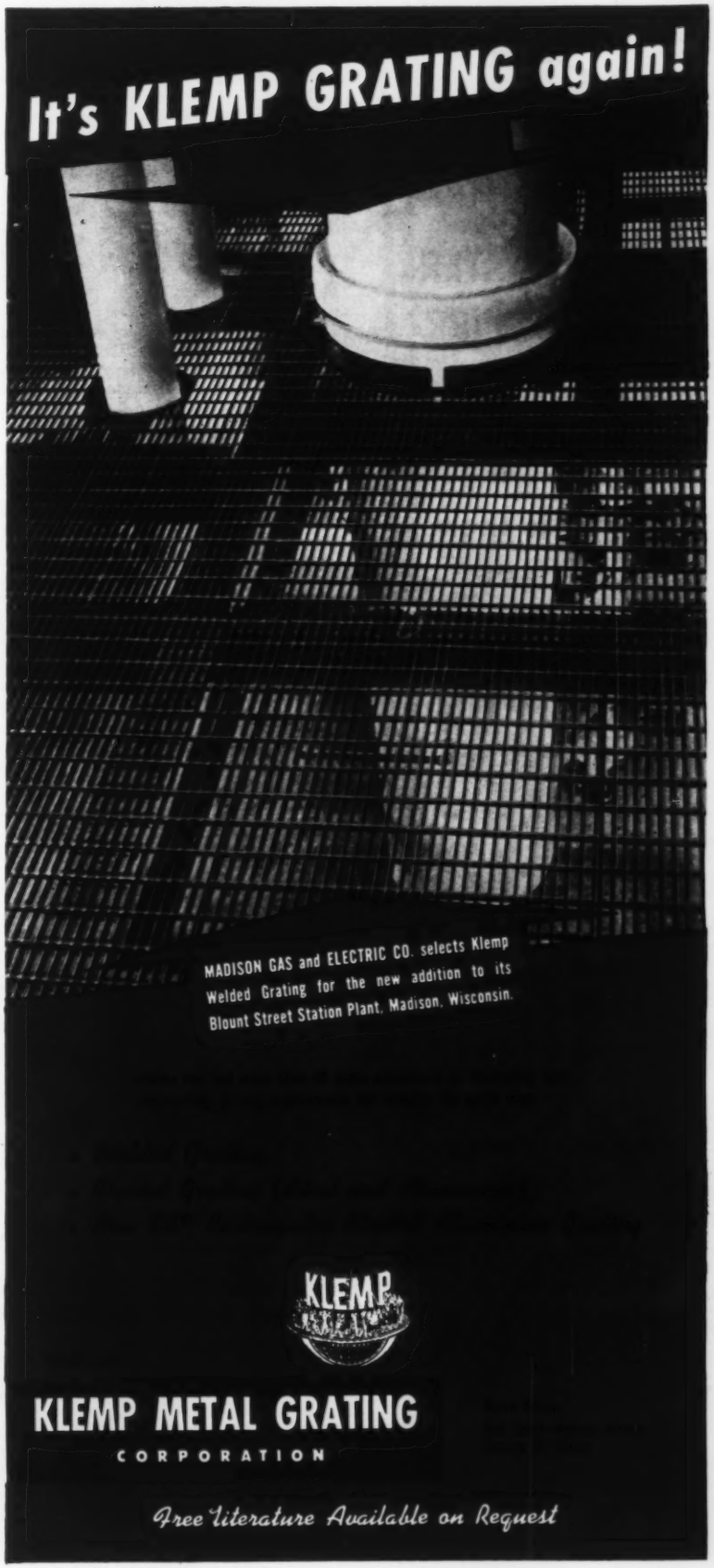
George A. Nelson has retired from the Coast and Geodetic Survey after 31 years of service. Recently Captain Nelson has been engaged on field inspection of the Columbia River and the coast of Washington for the revision of the Coast Pilot volume covering that area. Captain Nelson is credited with the design and development of a camera for photographing planimetric maps in perspective at exact scale and flying height for the use of the Air Force. Captain Nelson resides at 10329 Valmay, Seattle, Wash.

Fred W. Clayton for the past four years a member of the Public Service Commission of Nevada, has accepted a staff position with the Federal Communication Commission as assistant chief of the Common Carrier Bureau in Washington, D. C. Mr. Clayton recently served as president of the Nevada Branch of the Sacramento Section.

Fred W. Clayton

The Board of Directors of Gannett Fleming Corddry and Carpenter, Inc., Harrisburg, Pa., announce the following changes in the officers of the corporation: **Farley Gannett,** chairman of the board; **S. W. Fleming, Jr.,** vice-chairman of the board and treasurer; **W. H. Corddry,** president; and **J. D. Carpenter,** senior vice-president. The board also announces the formation of the associated partnership of Gannett Fleming Corddry and Carpenter. Members of the partnership are **W. H. Corddry, J. R. Dietz, J. D. Carpenter** and **R. W. Foster.**

(Continued on page 32)


It's KLEMP GRATING again!
MADISON GAS and ELECTRIC CO. selects Klemp Welded Grating for the new addition to its Blount Street Station Plant, Madison, Wisconsin.
KLEMP
KLEMP METAL GRATING
CORPORATION
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Write for pamphlets describing "In The Dry" Pile & Pier Repair

DRI-POR SYSTEMS
Baltimore 26, Md.

News of Engineers

(Continued from page 31)

David Hopkins has joined the Standard Fruit & Steamship Company of New Orleans, La., as assistant to the vice-president for new works and development. He is currently responsible for the planning of new terminal facilities at New York and Charleston, S. C. Mr. Hopkins was formerly with Tippetts-Abbett-McCarthy-Stratton, consulting engineers of New York.

George F. Sowers, professor of civil engineering at Georgia Tech, and consulting engineer, Law-Barrow-Agee Laboratories, and three graduate students, **C. H. Mullis, Jr.** (Linden, N. J.), **A. J. Glenn** (of Atlanta) and **A. D. Robb** (Greenock, Scotland) presented a paper on soil engineering at the Fourth International Conference on Soil Mechanics and Foundation Engineering held in London in August. The paper was one of 25 selected from the United States and 150 from the entire world as a significant advance in soil engineering since the last conference four years ago. Professor Sowers represented the joint authors at the seventeen-day conference, which featured inspection trips to engineering projects in England and Scotland.

Prof. Carl H. Koontz, on the staff of Worcester Polytechnic Institute since 1952, has been named head of the civil engineering department there.

Garvin H. Dyer, director of the Missouri Water Company and manager and chief engineer of the Independence (Mo.) Division of the firm, has been elected president of the National Society of Professional Engineers. Regional vice presidents elected for the coming year are **John B. McGaughy,** Norfolk, Va., southeastern region; **Harry G. Kennedy,** Charleston, W. Va., central region; **W. L. Hindermann,** St. Paul, Minn., north central region; **Clark A. Dunn,** Stillwater, Okla., southwestern region; and **L. R. Durkee,** Seattle, Wash., western region.

David Picket, chairman of the board and president of the Gotham Construction Corporation of New York, announces the 25th anniversary of his firm, which was founded by his father. The firm has built many impressive structures. Among its most recent achievements are buildings for Montefiore Hospital and the New York City Joint Diseases Hospital.

David Picket

(Continued on page 118)

Yes, it will be appreciated for a lifetime . . . as a compass, transit, level, plumb, alidade and clinometer. *Write for Booklet*

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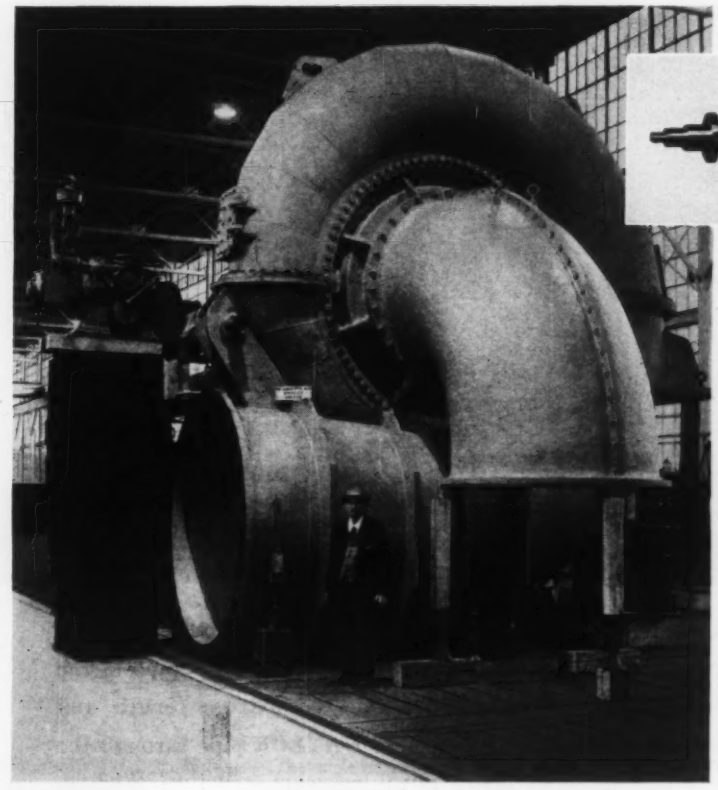
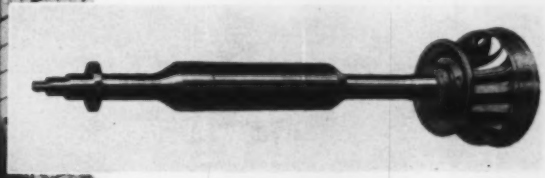
Rockaway, N. J.

LEFFEL BUILDS GIANT HORIZONTAL TURBINE FOR PLEASANT VALLEY

The low net head of 68 ft. at the Pleasant Valley Power Plant near Los Angeles required the design and construction by Leffel of a giant, horizontal spiral case turbine unit. This turbine, rated to develop 3,520 H.P. under the net head of 68 ft. at a speed of 257 R.P.M., drives a horizontal generator. A common shaft carries both the generator rotor and the stainless steel runner. A synchronous by-pass valve allows adjustment of flow for both turbine and by-pass discharge to meet water passage requirements. Photographs here show this giant turbine in various stages of production at the modern Leffel plant.





Leffel has the technical know-how and modern plant facilities to design and construct efficient, economical, rugged turbines of most types and capacities. And Leffel provides fast, complete service. Field engineers are available to assist you in the original planning of your project, and to help you with the actual installation of your turbine.

If you're planning a new project, or the rehabilitation or expansion of old facilities, and you want fast, complete service, contact Leffel, producers of top performing turbines. Mail the coupon below, today, for complete information.

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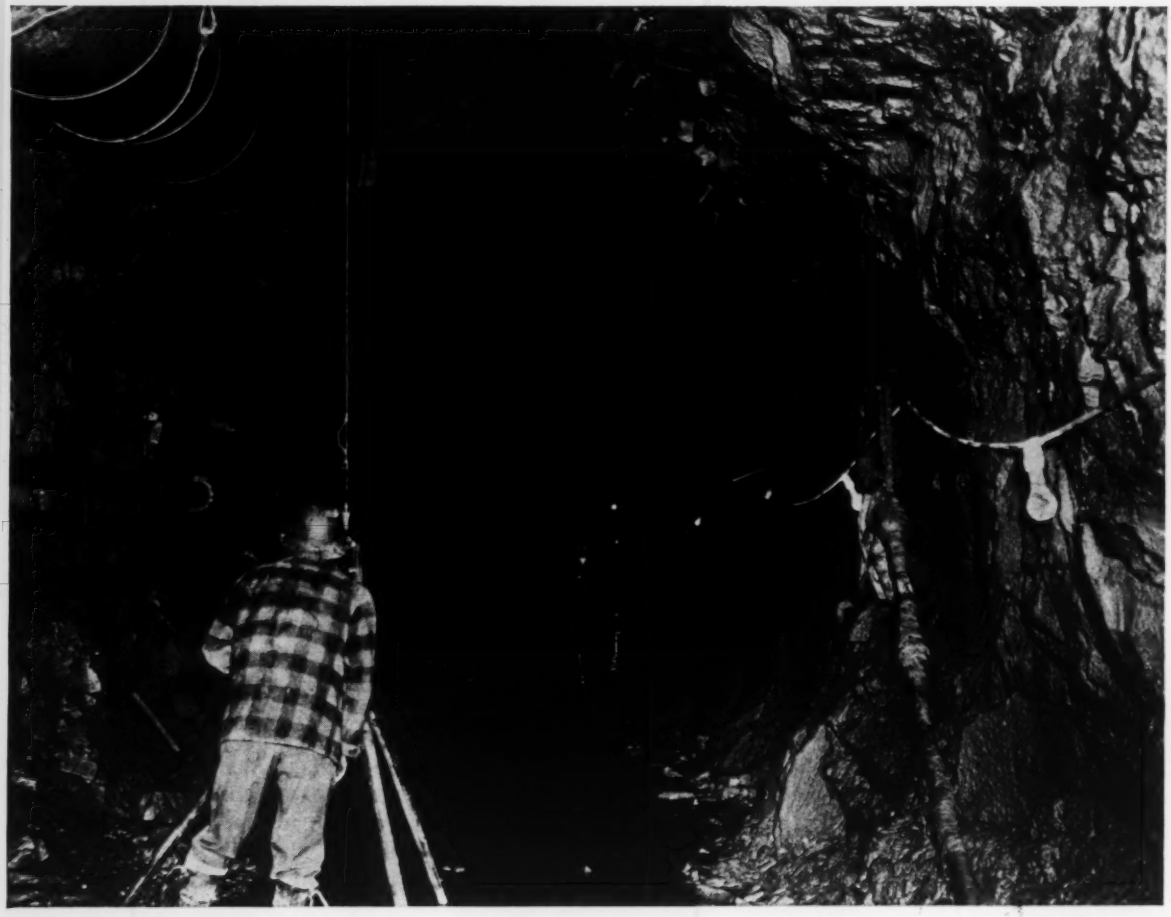

NAYLOR pipe makes it easy to provide fresh air underground. It's easy to handle and install in tunnels because it is light in weight. And it's easy to extend as work progresses . . . particularly with the one-piece NAYLOR Wedgelock coupling to speed connections. Lines hug the wall and can be connected with only one side of the pipe in the open. You'll like the extra strength and safety built into NAYLOR pipe through the exclusive spiral lockseam structure. For details, write for Bulletins Nos. 507 and 514.

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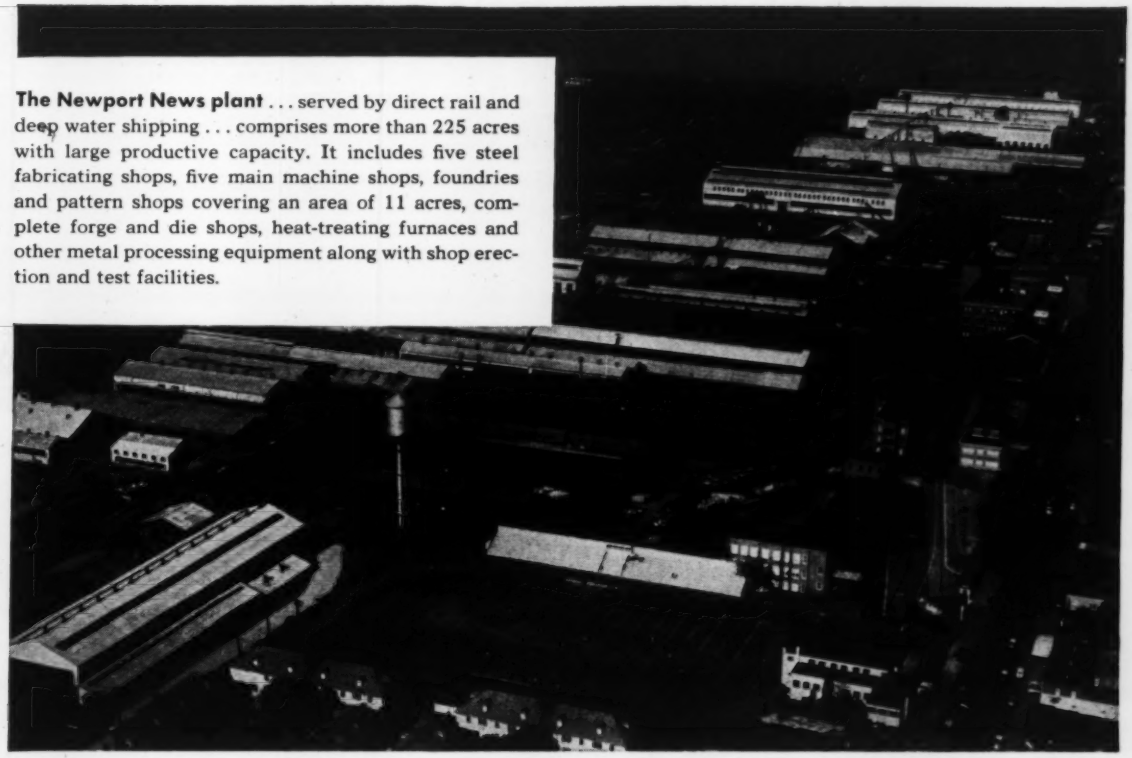

The Newport News plant . . . served by direct rail and deep water shipping . . . comprises more than 225 acres with large productive capacity. It includes five steel fabricating shops, five main machine shops, foundries and pattern shops covering an area of 11 acres, complete forge and die shops, heat-treating furnaces and other metal processing equipment along with shop erection and test facilities.

Make Newport News your source for fabricated metal structures

Let Newport News fabricate your weldments or sub-assemblies. Call on us for plate fabrication . . . from vacuum tanks to bridge caissons . . . for pumps, valves, pipe lines . . . you'll find that Newport News fabricates parts to answer most demands.

In the vast plant, shown above, Newport News craftsmen complete your orders with specialized production techniques, and with sound experience acquired through construction of thousands of products ranging from small components on rayon spinning machines, to the giant 165,000 hp hydraulic turbines at Grand Coulee.

See for yourself what Newport News is doing, and how this company's high integration of skill and production facilities can help you. Get the facts, shown in *Facilities and Products.* A copy of this illustrated booklet is yours for the asking . . . write for it now.

Newport News
Shipbuilding and Dry Dock Company
Newport News, Virginia

Why they used PLASTIMENT in the PELICAN ISLAND CAUSEWAY

The Pelican Island Causeway at Galveston, Texas carries a two-lane highway and a railroad track across more than a mile of water. Earth fill supported by cantilevered concrete sheet piles runs 1000 feet from the mainland. Concrete trestle construction totaling 4500 feet comprises the major portion of the crossing. Nine steel girder spans are used in the approach to the 160-foot single leaf bascule which spans the ship channel.

OWNER: Galveston County Navigation District No. 1
CONSULTING ENGINEERS: Parsons, Brinckerhoff, Hall and Macdonald (New York City). Resident Engineer, Arthur Alpert.
GENERAL CONTRACTORS: Farnsworth & Chambers (Houston). Kansas City Bridge Co. (Kansas City). Texas Gulf Construction Co.(Galveston).
PRESTRESS SUB-CONTRACTOR: Span, Inc. (Dallas).
READY-MIX SUPPLIERS: Horton and Horton (Houston). W. A. Kelso (Galveston).

- **prestressed beams**
- **prestressed bearing piles**
- **prestressed railroad decks**
- **tremie concrete**

Rapid production and erection of prestressed bearing piles, beams, and railroad decks are among the factors responsible for outstanding success in construction of the Pelican Island Causeway.

Two properties of Plastiment were deemed extremely advantageous to the concrete work on this project. The first of these was the increased density of the finished product, which was vital to resist spalling and other damage from the polluted sea water in Galveston Bay. The second advantage was the retarding property of Plastiment, which delayed the initial set of concrete in the 400-foot prestressing bed on a hot summer's day long enough to complete the pour, and start the steam curing before temperature cracks appeared. Additional advantages of better workability with less water and increased strength were apparent during production.

Plastiment Concrete Densifier is a versatile aid for achieving a uniform, dense concrete at all seasons of the year. Uniform quality means economy! Let Plastiment help you . . . write or call for information.

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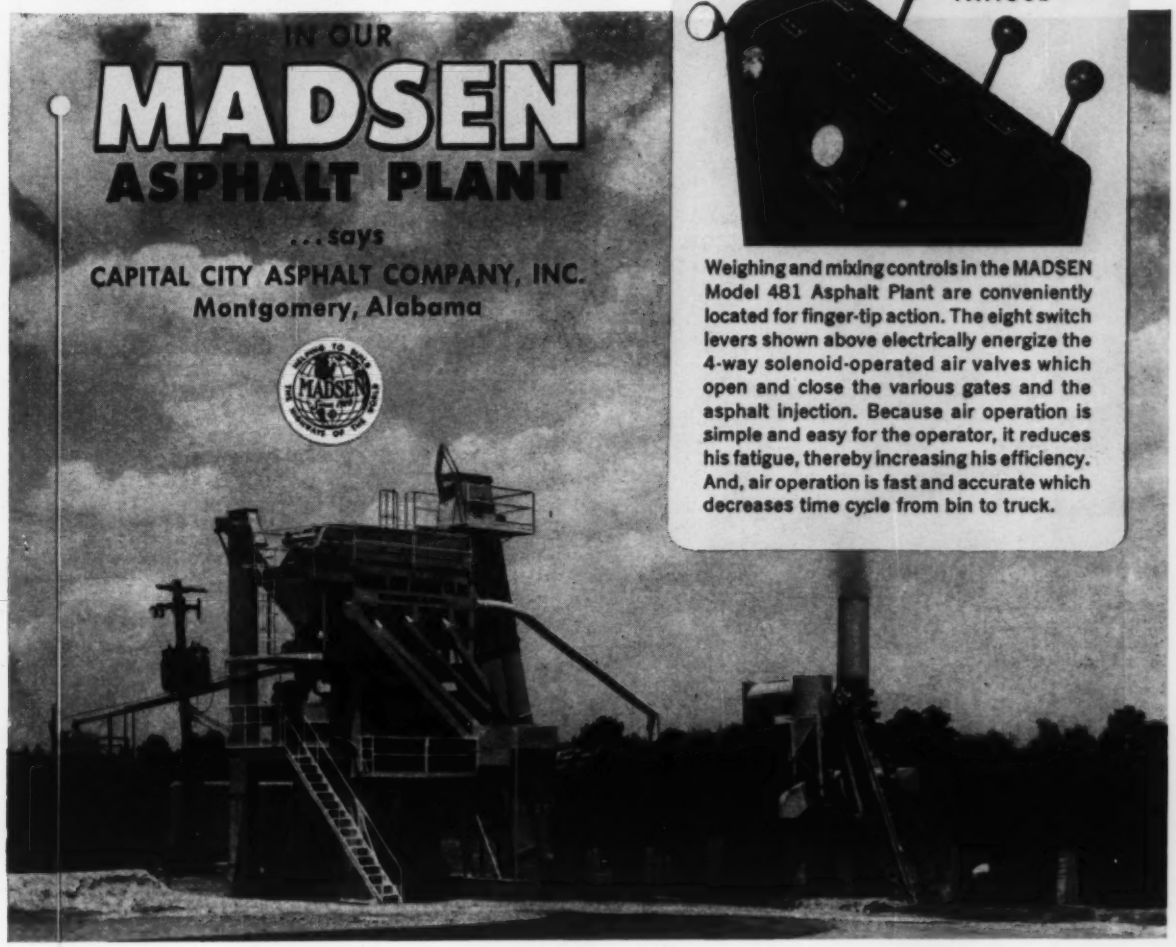
Montgomery, Alabama



FAST, EASY OPERATION MEANS LESS OPERATOR FATIGUE

Weighing and mixing controls in the MADSEN Model 481 Asphalt Plant are conveniently located for finger-tip action. The eight switch levers shown above electrically energize the 4-way solenoid-operated air valves which open and close the various gates and the asphalt injection. Because air operation is simple and easy for the operator, it reduces his fatigue, thereby increasing his efficiency. And, air operation is fast and accurate which decreases time cycle from bin to truck.

▷ Owners of MADSEN Model 481 Asphalt Plants are quick to praise the fast-action, finger-tip control of the weighing and mixing operations. Capital City Asphalt Company, Inc. of Montgomery, Alabama, who own and operate the 4000-lb. MADSEN Model 481 Asphalt Plant shown above, rate this MADSEN advantage a most important factor in obtaining maximum daily production. After completing a contract calling for 25,000 tons of hot mix for city streets, this well-known contractor says *"our MADSEN Model 481 gives us a very good volume of production with a minimum of operating costs."*

The MADSEN Model 481 Asphalt Plant is big, oversize throughout with larger elevator, screen, bins, weighbox, mixer and drives. The 6000-lb. plant can easily handle 180 T.P.H. on a one-minute mixing cycle, with user claims nearing the 300 T.P.H. mark. The Model 481 is available in 4000-lb., 5000-lb. and 6000-lb. batch capacities. (If purchased as a 4000-lb. plant the Model 481 may be converted to a 5000-lb. or 6000-lb. plant with only minor modification costs.)

Combine the big MADSEN advantages of easier operation, greater economy of operation, bigger day-in and day-out production with long-range, in-built MADSEN versatility, and you can see why more and more successful asphalt producers are buying MADSEN. Why not get the complete MADSEN story today.

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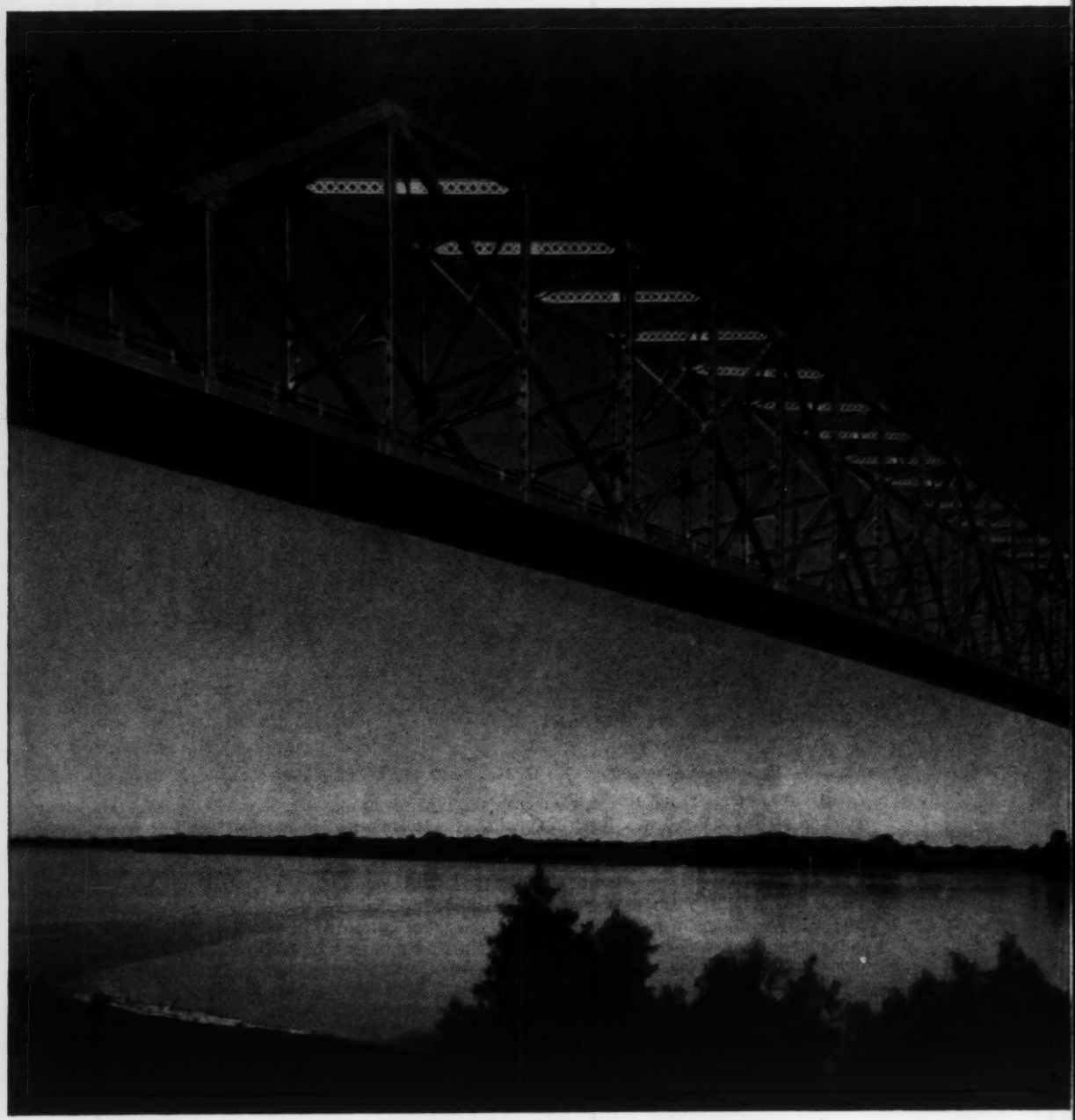
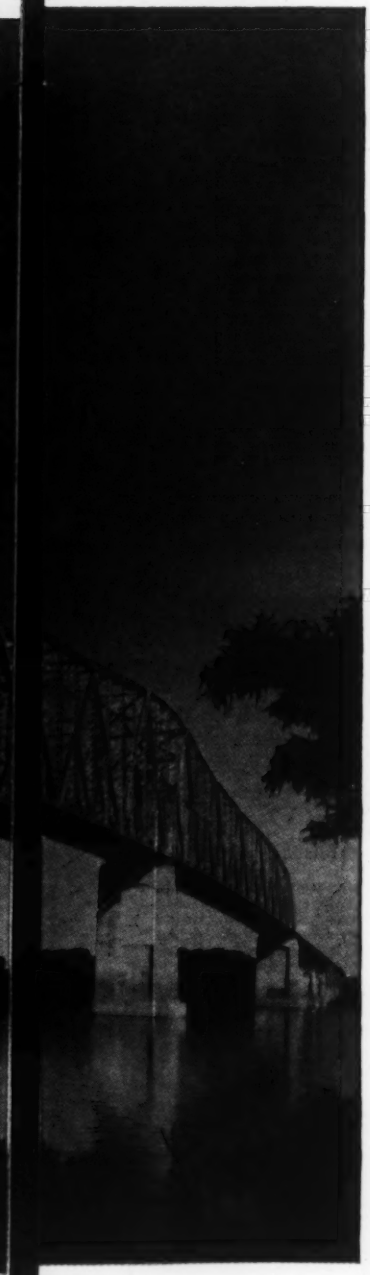
In America's longest two-span



USS HIGH STRENGTH STEELS

—the big step forward in bridge construction

continuous through-truss bridge...



High Strength USS TRI-TEN "E" Steel reduces dead weight 400 tons

THIS imposing structure, the Shawneetown Bridge, straddles the Ohio River at Shawneetown, Illinois. Its total length is 3,200 feet. Each approach consists of a 150-foot simple truss, a two-span continuous deck truss and three units of three-span continuous beams.

The two main spans deserve your particular attention. Designed to meet navigational requirements, they are each 825 feet long—*the longest spans of their kind in this country.*

Because in spans of this length, dead-load stress is about 80% of the total stress in the main members, reduction of dead load is highly desirable and can result in real savings. For this reason, USS TRI-TEN "E" Steel was specified for the main spans.

Built with USS TRI-TEN "E" Steel, top and bottom chords, diagonal truss members, bottom laterals and other highly stressed members weigh only 80 to 85% of what they would weigh if built of structural carbon steel. As a result, the 2,350 tons of USS TRI-TEN "E" Steel used in the main spans eliminated over 400 tons of dead load.

The bridge was erected by cantilevering and these lighter trusses brought an additional advantage: reduced loads during erection.

• • •

Designers of steel structures, who have long sought to reduce dead load safely, have found in USS TRI-TEN "E" Steel an answer to their problem that is both practical and economical—particularly where long spans are concerned.

With a minimum yield point 50% higher than that of structural carbon steel (ASTM A7) in thicknesses of ¾" and less, USS TRI-TEN "E" Steel can safely be used in lighter sections to reduce weight and save steel. And these savings don't end with material costs. As proved in the many important bridges built with this stronger and more durable steel, lighter-weight structures mean lower freight costs as well as reductions in the size and cost of foundations. These savings, in some instances, have totaled as high as 15% of the cost of the structure.

Our engineers will be glad to show you how USS TRI-TEN "E" and our other USS High Strength Steels—USS COR-TEN and USS MAN-TEN—can be used to provide maximum strength, safety and durability with a minimum of weight and costs. Have you a copy of our new *"Design Manual for High Strength Steels?"* For your free copy, write on your company letterhead to United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pa.

The Shawneetown Bridge, Shawneetown, Illinois

Owner—Commonwealth of Kentucky
Designed by—Kentucky Department of Highways
Consulting Engineers—Sverdrup & Parcel, Inc., St. Louis, Mo.
Structural steel fabrication—Allied Structural Steel Companies

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • NATIONAL TUBE DIVISION, PITTSBURGH
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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

1933 USS HIGH STRENGTH STEELS 1957 — 24 YEARS OF PERFORMANCE

UNITED STATES STEEL

precast reinforced concrete pipe with...

locked-in protection

T-Lock Amer-Plate liner provides unequaled protection against corrosive acids, salts and alkalies and has proved to be impervious to high concentrations of hydrogen sulfide sewer gas.

The criterion by which a product is inevitably judged is its acceptance by the consumer. The Los Angeles Board of Public Works has awarded contracts for Precast Reinforced Concrete pipe, protected by T-Lock Amer-Plate, for their large diameter main trunk sewer installations. Thus, this community can be assured of trouble free service, economical maintenance and maximum life in these lines.

The long recognized qualities of strength and durability in Precast Reinforced Concrete Pipe plus the added proven protection afforded by corrosion resistant T-Lock Amer-Plate are a sure guarantee of permanence and economy.

Specify T-Lock Amer-Plate for your municipal or industrial sewer system and be confident that you are choosing the best.

Flexible sheets fit straight or curved surfaces, corners, etc.

Extruded T's, ⅜" high, anchor lining in concrete

Concrete poured in form

.060" thick, with dark glossy surface

The Precast Reinforced Concrete Pipe shown being installed here has been poured with the tough, non-porous vinyl plastic liner, T-Lock Amer-Plate. In the manufacturing process the Amer-Plate is wrapped around the inner form so that when the concrete wall is poured the T-shaped flanges are locked into the pipe wall. An unbroken, smooth lining is established very simply by heat-welding the material to itself at the pipe joints.

"Our Fiftieth Year"

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. . . . . *Am-Soc Briefs*

▶▶ "Something for every civil engineer" is how the Annual Convention Committee sums up the forthcoming (October 14–18) New York Convention. In case you missed the September issue, this is a last-minute reminder that there will be 42 technical sessions, the first Commercial Exhibit ever held at a Society Convention, an unusual choice of inspection tours, and of course a top-flight social program. . . . New members of the Board of Direction will take office, new Honorary Members will receive their citations, and new ASCE prize winners their awards. Brief biographies of these distinguished folk lead off Society News.

▶▶ Executive Secretary Wisely is representing the Society at the Europe-United States Engineering Conference (EUSEC), which is being held in Paris this September. Incidentally, U.S. contributions to this valuable conference, which is devoted to engineering education, are now available in preprint form (coupon for ordering on page 162). . . . While he is in Europe Mr. Wisely will go to Essen, Germany, to confer honorary membership on Dr. Karl Imhoff, famous sanitary engineer, who will not be able to make the long trip to the New York Convention to receive his citation.

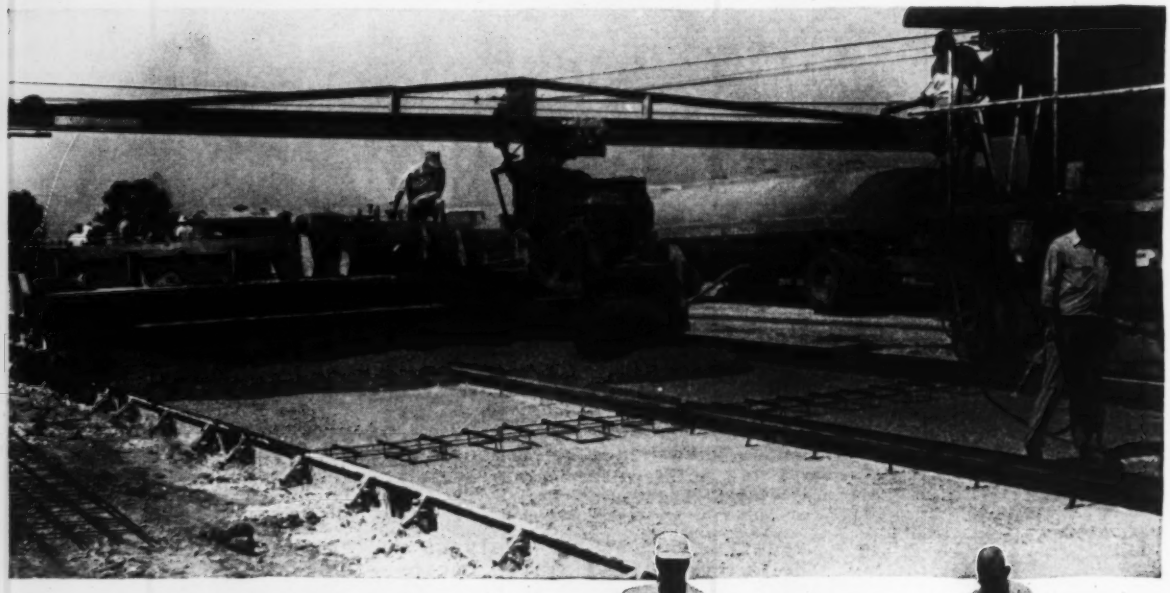
▶▶ Also abroad in the interest of increasing international understanding in the profession is ASME Secretary Clarence E. Davies. In his new post as building coordinator for the proposed United Engineering Center, Mr. Davies is inviting representatives of thirteen leading European engineering societies to enjoy the facilities the Center will offer. . . . The architects' rendering for the 20-story Center will be reproduced in the November issue.

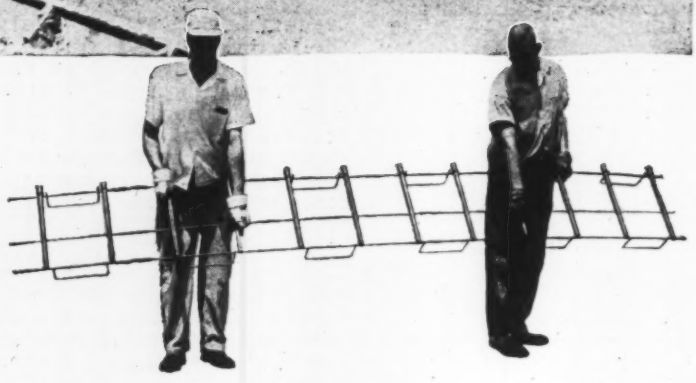
▶▶ Latest tabulation of the ASCE Engineering Salary Index shows a continuing upward trend in both consulting offices and state highway departments throughout the country. Increases averaged about 2 percent over the previous quarter. Gains on the West Coast generally exceeded the other sections of the country.

▶▶ The Construction Division brought out its first Technical Journal this August — a group of five papers on Variable-Angle Launchers. A regular publication schedule is planned by the Division's Committee on Publications, which is headed by M. D. Morris. . . . Many Construction Division papers, of course, appear in "Civil Engineering."

▶▶ Congratulations are in order. . . . For the Maryland Section, which has set itself the task of "a new member for every member." Though too early to assess final results, "we know of a number of new members who became interested in the Society through this means," reports Secretary-Treasurer James W. Davis. . . . For the Kansas City Section, which has asked ten neighboring Sections to join it for a two-day Highway Conference on November 7 and 8. The program will be on the all-important subject of planning and designing the freeway system.

▶▶ At Headquarters. . . . Francis J. Schneller, Jr., J. M. ASCE, is a recent addition to the Headquarters staff in the post of Assistant Editor of Technical Publications.





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Save Field Labor...

Speed Highway and Airport Construction

All parts of Laclede dowel assemblies for expansion, contraction and construction joints (expansion sleeves, chairs, spacing devices) are precision-welded into one unit at the plant before delivery to the job. This pre-assembly insures an accurate easily handled one piece unit permitting fast installation with reduced field labor costs. The dowels are maintained in rigid alignment. Where specified, the units may be furnished painted or coated, eliminating a time consuming and costly job operation.

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do you know that

There is a rumbling pavement that warns motorists of stop-sign intersections? For the past two years the Cook County (Illinois) Highway Department has been successfully experimenting with a specially treated surface that noisily alerts the driver to the danger of approaching intersections. The built-in alarm consists of a 300-ft lane primed with liquid asphalt and overlaid with sufficient particles of screened slag to cause an audible rumble when a car rolls over it.

• • •

Target date for opening the new Mont Blanc Tunnel is sometime in 1960? When completed, the 7.3-mile tunnel—linking Chamonix in France to the entrance to the Val d'Aosta in Italy—will be the longest highway tunnel in the world and will bring to five the number of all-year links across the Alps. It will cost $25,700,000 and will bring in about $2,000,000 in annual tolls. There are thirteen other routes across the 775 miles of border connecting Italy, France, Switzerland, and Austria, but winter weather keeps them closed up to eight months of the year. Source for this is the September issue of *World Highways*.

• • •

The Greenland ice cap may become the world's deep freeze? For the past two years Army engineers have been blasting and drilling a great tunnel into the face of the Greenland ice cap and lining it with experimental storage chambers. In this place of dead cold, the temperature stays an even 14 deg F winter and summer. In addition to studying the practicability of under-ice storage chambers for crop surpluses and perishables, the project will seek to determine how much stress ice will stand. Lt. Col. Elmer F. Clark is commander of the Corps of Engineers' Arctic Camp.

• • •

A tremendous population boom is forecast? As the U. S. Bureau of the Census and planning groups see it, in the next eighteen years our numbers will be increased by 60,000,000—more than the present population of the British Isles, France, Western Germany, or Italy. Region-wise, the West and South will gain most of the new population, 18,000,000 and 15,000,000 respectively. Some 14,000,000 are expected to live in the Midwest, and the remaining 13,000,000 in the already overcrowded East. The increase will be the natural result of the high birth rate prevailing since 1948.

• • •

An extensive crack has just been discovered in the ocean floor off Alaska? Coast and Geodetic Survey ships operating in Alaskan waters this summer have taken soundings (by electronic echo-sounders) that confirm the existence of the crack. The trough, which had long been suspected, lies from 500 to 700 ft below the sea floor in the Gulf of Alaska. It is from 250 to 400 miles long, and from 2 to 3 miles wide. The significance of the trough is that it is a possible spawning ground for the disastrous seismic waves that rush southward over the Pacific.

• • •

Los Angeles now leads the nation in new construction? Contributing importantly to its building boom were the 89,262 new dwellings—with a total building permit evaluation of $1,579,600,000—put up last year. For comparison, 15,000 more dwelling units went up in Los Angeles last year than were constructed in the entire state of New York, and about 10,000 more than in Texas and Pennsylvania combined. With a gain of more than 200 new residents each day, Los Angeles by 1975 will have to provide office space, factories, and homes for 800,000 additional residents. Local engineers do not expect a sudden rash of skyscrapers, despite recent repeal of the twelve-story height limit.

• • •

Jarrah timber (a species of eucalypt) is almost indestructible? Native to Australia, this useful tree is successfully grown now in twenty other countries. In addition to resisting decay, termites, and shipworms, it is fireproof to such an extent that in some parts of the world it is popular for chimneys. Jarrah wharf piles have been found sound after fifty years. For over half a century, moreover, traffic in the busiest districts of London and Paris has rolled over paving blocks of jarrah. Credit for this information to John Sidney, who writes about the eucalypt in the September 1957 issue of *Natural History*.

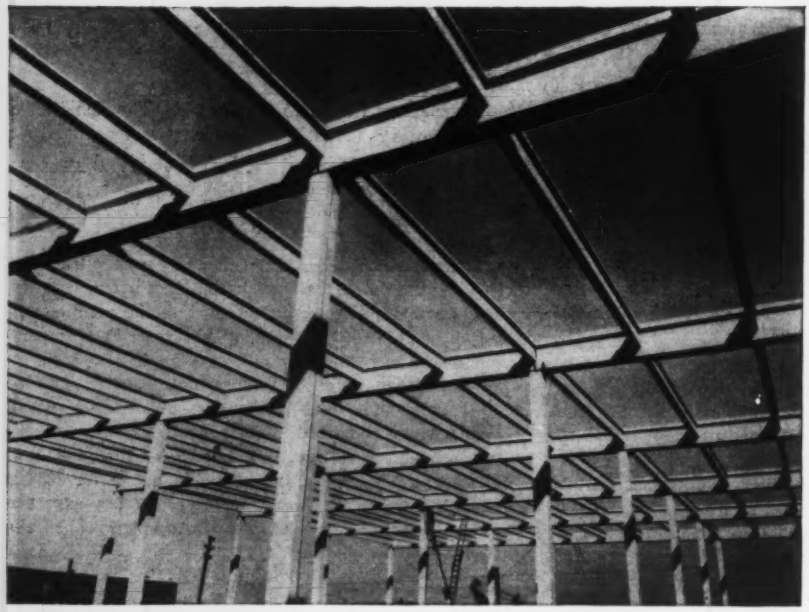
• • •

It was Benjamin Franklin who first advocated Daylight Saving Time? Back in Colonial times far-seeing Franklin had the idea of putting the clocks ahead as a means of saving money on candles. Speaking of time, most members doubtless know that Standard Time—with the staunch backing of ASCE—was adopted 74 years ago this November.

• • •

The engineer in government employ is low man where salaries are concerned? The increase for this group in the four-year period, 1952-1956, was only 12 percent, the National Society of Professional Engineers reports in its 1956 Salary Survey. The competition for recent graduates is reflected in a 28 percent increase in the earnings of the preprofessional group during the same period. Findings for 1956 show that the chemical engineers came out best, with a median earning total of $11,000. Civil engineers, sadly enough, had the lowest median earning of any of the major branches with a figure of $8,750. The 1956 Salary Survey may be obtained from the NSPE headquarters, 2029 K Street, N. W., Washington 6, D. C. It will be $1.00.

FRAMEWORK OF THE FUTURE IS GOING UP *Today!*



New "Savarin" Coffee Plant of Slim, Clean Precast Concrete is Functional Beauty

● This bright, light, efficient plant is proof of modern concrete's versatility, speed and economy of erection. The 130 columns, 95 girders and 425 purlins went up in just 7 working weeks.

CHECK THESE CONCRETE FACTS

Here's what architect and owner want in a new building. Here's what precast and prestressed concrete gives them:

- a maintenance-free, corrosion-free structure
- elimination of fire hazard, hence favorable insurance rates
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- flexibility for expansion through variety of shapes, sizes and weights made-to-order at no premium cost
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- quicker starts, earlier finishes by using 'Incor' high early strength cement, in assembly line production through fast stripping and re-use of forms

Dependable 'Incor'*, America's first high early strength cement, is a major reason why precast, prestressed buildings such as this are the Framework of the Future rising everywhere *Today*.

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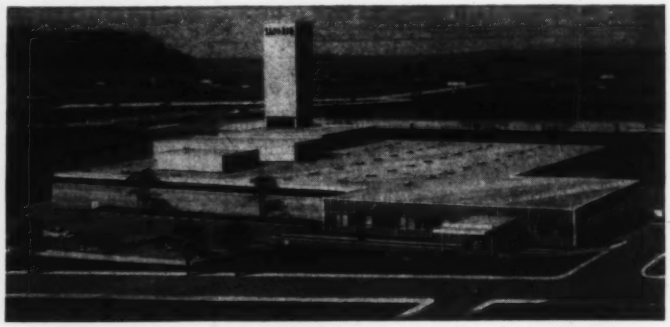
Architects: **POMERANCE & BREINES**, New York City
Structural Engineer: **HARWOOD & GOULD**, New York City
General Contractor: **WALTER KIDDE CONSTRUCTION COMPANY**, New York City
Precast Sections: **FORMIGLI CORPORATION**, Williamstown Jct., New Jersey plant



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CIVIL ENGINEERING

ONE YEAR LATER

Address to be presented at ASCE Annual Convention, Oct. 16, 1957

MASON G. LOCKWOOD, Retiring President of ASCE

Partner, Lockwood, Andrews & Newnam, Houston, Tex.

At the 1956 Annual Convention, a year ago, I emphasized the obvious truth that a President is better qualified to make his inaugural speech when he becomes an immediate Past President. He will then have had a year's intimate association with the Society's membership, its Local Sections, committees, and Board of Direction. The inaugural address which, nevertheless, was given under the title, "Forty Thousand Heads Are Better Than One" (CIVIL ENGINEERING, November 1956, p. 33), dealt largely with what I then conceived to be the principal weaknesses of ASCE, as enumerated in a large number of personal letters solicited from Local Section officers.

My purpose then and throughout my tenure has been to concentrate on these soft spots in our Society—if indeed they are soft spots—in the hope that they could be either eliminated or strengthened this year, or that machinery could be set in motion for their ultimate elimination or strengthening.

Now, one year, 89,000 miles, 45 Sections, 35 states, seven countries, 800 letters, 79 speeches and one granddaughter later, I should like to report on progress in dealing with these weaknesses.

On assuming the Presidency I discussed, in order, the features of ASCE which my letter survey indicated most needed attention. It seems logical, as I leave office, to report on these matters again in the original order of membership concern. I am determined to do this in relatively few words. The keynote for the future will be struck by our new President. The dead past really should bury its dead. When the King is dead, I want to be the first to proclaim, and truly to mean, long live the King!

Younger members

During the year, the Society conducted a searching investigation and reexamination of its policies relating to Junior Members, who make up 44 percent of its total membership. An attempt was made to measure the degree of validity of the two most commonly heard complaints: (1) that "Junior" is a poor designation for the first grade of membership, and (2) that we lose too many Junior Members —perhaps because of our unique up-or-out rule.

This investigation was made by the Task Committee on Classification of Members, to which the Board assigned the project a year ago. The Committee has recommended sweeping changes in membership classifications. The five grades of membership would be retained. But the three principal grades —Junior Member, Associate Member, and Member—would be renamed, and changed somewhat in other ways. Juniors would be called Associate Members; Associate Members, Members; and Members, Senior Members. Only graduates from schools of recognized standing would be admitted as Associate Members. There would be no minimum age requirement, but transfer to a higher grade would be mandatory within 12 years of graduation—with exceptions for military service.

The Board caused these proposals to be widely publicized through regular Society media, and by direct mail it has solicited membership reactions through the Local Sections. The Task Committee is directed to review these returns and report finally in time for Board action February 24-25, 1958.

If these reclassification amendments are adopted by the Board and by the membership, or if they are adopted in so far as the entrance grade is affected, the term Junior will be eliminated.

A study made under the direction of the Executive Secretary, and carefully examined by the Task Committee, fails utterly to confirm the reported failure of the Society to attract and hold young engineers in numbers proportionally comparable to those recruited into AIChE, AIEE, AIME and ASME. The study uncovered these very significant but widely overlooked facts:

Only ASCE has no student member grade and therefore limits students to membership in a Student Chapter.

The percentage of graduating civils admitted to ASCE is much higher than the corresponding percentage for any of the other societies.

Only ASCE requires professional advancement—as measured by admission to the grade of Associate Member—as a condition of permanent membership.

The up-or-out rule, which accounts for the proportionally higher losses from our Junior Member grade, is a quality-improving and stabilizing fac-

tor, a source of strength—not a weakness—in ASCE.

The percentage loss from all but the entrance grade in ASCE is lower than for any of the other societies—not half as much as the average, in fact.

Professional and economic advancement

The professional committees operating under the relatively new Department of Conditions of Practice have been increasingly active. All deal with the problems affecting either the professional or the economic advancement of civil engineers. Despite this increased activity, members in substantial numbers seem to want the Society to do more. Other members, though perhaps not so many, have criticized it for doing too much in this direction. A reasonable conclusion is therefore that ASCE has its programs of technical and professional activities rather well balanced.

In response to the persistent demand for a more positive approach to advancement, two years ago the Board put to work a Task Committee on Study of Economic Advancement Objectives. This Committee has just completed its work. It has just submitted its final report for Board consideration —on October 14-15, 1957—a series of recommendations for attainment of immediate and long-range objectives. These recommendations include: strong representation for the Society in Washington, under the direction of headquarters staff, and support for early profession-wide representation there by EJC; personnel increases for headquarters staff as required for assistance to employers and employees in maintaining equitable classification and salary schedules for civil engineers; modification and upward revision of present fee curves; aggressive leadership for a unity organization representing the entire profession; and greater emphasis on registration, public relations, higher quality of engineering education and professional relations.

Communications and public relations

Dissatisfaction with our system of internal communications should be—and I believe is—lessening.

Vehicles such as the new and thoroughly readable Annual Report, which now reaches every member, together with new and telling features on news of the Society in it periodicals and other publications, are beginning to satisfy the written-word aspect of the communications need. More regional meetings, better representation at Local Section and Faculty Adviser conferences, and especially much increased and better planned visiting by national officers and staff, are beginning to fill the oral need.

In public relations, membership expectation is perhaps somewhat unrealistic. Yet the Society should be able to do better. The most encouraging aspect of this situation, to me, is the fact that our staff is under the direction of an Executive Secretary who is exceptionally public-relations minded for an engineer. He has a good understanding of people and, even more relevant, a previous record of high achievement in public relations. There is forthcoming a staff-prepared manual on public relations for Local Section guidance, as well as other innovations. I believe noticeable improvement is imminent.

Membership apathy

Apathy is an insidious disease to which some quarters of any large organization are subject. It is infectious, and tends to spread. While it is seldom fatal, it often is devitalizing. Every effort should be made to stamp it out.

Despite the complaints heard about the apathy of too many of our members, I am convinced we are gaining ground in the Society's determination to serve the membership better than ever before. If so, it matters little—though it is regrettable—that some of our members cannot be blasted out of their professional lethargy.

Closer national-local relationships

The complaint that relations between the national and local levels of our Society are not close enough will perhaps always be valid. Perfection here is as difficult as in a parent-child relationship.

The national group—Board, committees and staff—when well advised, will want to do nothing that can be done better by a self-reliant complex of Local Sections. But the family rules must, in the final analysis, emanate from the top.

These inherent drawbacks notwithstanding, the Society unquestionably is making good progress in maintaining closer national-local relations. To the extent that there have been improvements in internal communications, there have been improvements here. The most effective step is the previously mentioned much-increased, better-coordinated schedule of visits by staff and national officers.

Unity of the profession

I took office thinking that engineers, from frustration or boredom, were tired of talking about unity of the profession. But I was wrong, utterly wrong. They want to talk about it everywhere. If you do not bring it up, they will. Unity may never before have been a livelier topic. Things they say about it are sometimes startling. Recently the President of a Local Section, before he had known me 15 minutes, bluntly asked: "What's going on, have EJC and NSPE finally declared open warfare?" This recalls Garry Moore's alleged quip: "There will be someone to criticize nearly anything you say on television these days. If you should say Happy Mother's Day, someone will complain, 'What's wrong with him, doesn't he like his Father?' "

The unification struggle of the past fifteen years is a depressing record of unsatisfactory professional progress. This is a leadership failure. Yet all the leaders seem to have wanted unity as earnestly as the rank and file, who I am positive want it desperately. But highly placed representatives of opposing concepts have too often only wanted unification on their own terms.

There has been too much stubbornness, too little statesmanship. We have proved that the profession cannot be united that way. It is unrealistic optimism to expect the impasse to be broken by the unconditional surrender of one or the other of these opposing concepts. Compromise is inevitable if true unification is inevitable.

The engineers of this country appear to be quite unwilling to wait another generation for a satisfactory unity. The natives are restless. If we are really to have unity in our time, I believe the instrumentality for it must be the structure of the going concern, Engineers Joint Council.

Although not ideally at present, EJC does already officially represent some 300,000 engineers. The National Society of Professional Engineers, the only major national society not yet affiliated with EJC, is growing rapidly in membership and influence. It represents about 50,000 engineers, but that probably is a bit less than 10 percent of the profession as a whole. Not even a professional optimist would predict that NSPE can represent a majority of the profession within our time.

What then is more logical than that NSPE should join EJC now? Then all of us might begin to participate in the benefits of a very substantial unification. I believe NSPE will grow much faster as a member of EJC.

Consider the alternate ideas for unity now. One is a three-headed unity device. ECPD would ride herd on the educational, EJC on the technical, and NSPE on the professional aspects of engineering. About this one, I only ask, Is it a step in the right direction? The other alternative would be for 200,000 or so additional engineers to join NSPE right now, then to scrap EJC. About this I only ask, is it realistic?

CHESTER W. CAMBELL
President, The Foundation Company, New York, N. Y.

General excavation of 400 X 160-ft site for Chase Manhattan Bank Building starts down through old building debris.

Chemicals seal foundation for New York building

Chemical grouting has just been used successfully as an aid in constructing foundations for one of New York's new and spectacular building projects. The structure, the Chase Manhattan Bank's head office building, is set in from the lot lines on a 400 by 160-ft site in the block bounded by Nassau, Liberty, William, and what was Cedar Street. Each of its sixty stories has an area of 281 by 107 ft. The full area of the site is being excavated to bed rock and, in some places, extends into bed rock as much as 21 ft to provide useful basement space. A decked over plaza will surround the building. The elevation of the bottom of the excavated area will average about 85 ft below curb level.

The first 20 ft of excavation below street level went through old foundation walls, basement floors and debris. Then, for some 20 ft below the bottom of the old building footings, the subsoil consists of a varved red silt. Below this is a layer of hardpan filled with boulders and some lenses of sand. The next material encountered is Manhattan schist, the first few feet of which is rotten rock on top of bed rock of varying degrees of hardness. The varved red silt is a very fine water-bearing material that has the feel of liver and for that reason is known in New York as "bull's liver." While this silt is saturated with moisture, water does not readily pass through it. However, the entire mass will run and it is necessary to exclude it from the excavation about as water would be excluded.

The layer of hardpan in some places is very dry, but in other places it contains lenses of water-bearing sand, which is very difficult to control. This sand will run and the water in it is free-running. The most difficult level is at the top of the rock where there is a mixture of boulders and sand along with cemented material forming hardpan.

Since the entire area of the lot below street level is to be utilized for basements six stories below Nassau Street, the outside walls down to and into rock had to be so constructed as to completely exclude all the difficult materials described above. Many methods of accomplishing this were considered, including (1) pneumatic caissons (2) open-trench construction using dewatering systems, (3) freezing, and (4) open-trench construction with the use of chemical grouting to consolidate the water-bearing strata.

A look into the past history of deep foundations in this part of Manhattan, indicated that pneumatic caissons had been generally used to reach bed rock. Probably the most notable example of earlier construction in the area is the Federal Reserve Bank, directly across Liberty Street, the foundations of which were constructed by The Foundation Company in 1922. For this work it was found necessary to use very high air pressure to reach bed rock.

Many problems other than technical were encountered in selecting both the method and the contractor for the Chase Manhattan structure. The owner, after exploring the field, chose a cost-plus-a-fixed-fee arrangement for

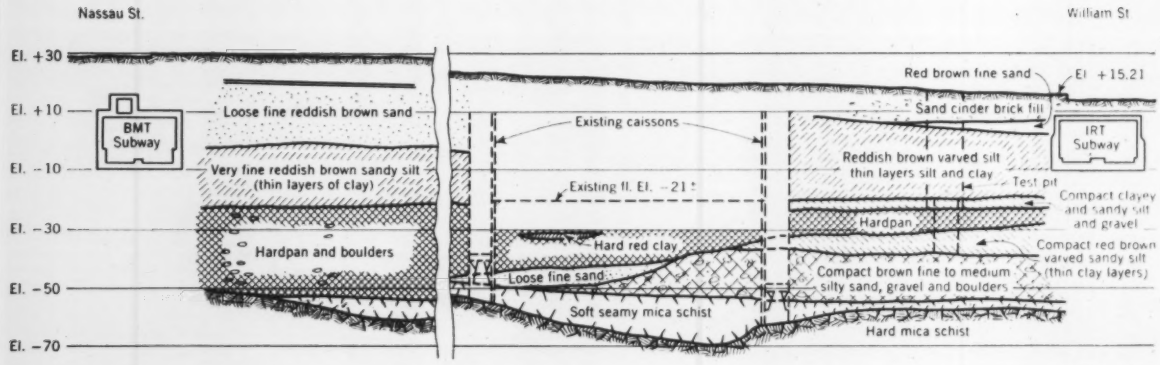
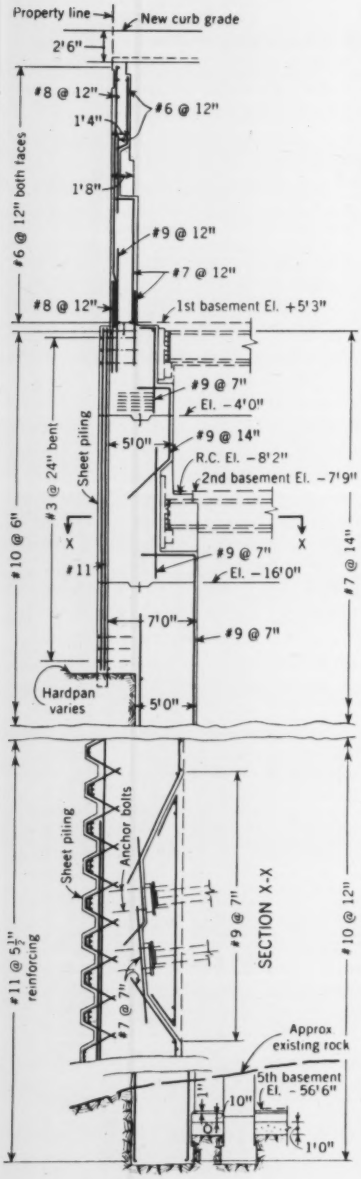


FIG. 1. Subsurface conditions on Liberty Street side of building site are illustrated. Sand and gravel layers are dangerously water-bearing.



constructing the foundations and contracted with a joint venture group made up of George M. Brewster & Son, Inc., Joseph Miele Construction Co., and The Foundation Company, the latter to act as sponsor and contract manager.

Subsoil conditions vary from place to place over the lot. Ground profiles, Fig. 1, show that the water-bearing stratum was a major problem for the most part at the easterly end of the site, particularly in the northeast corner, where Liberty Street intersects William Street. The BMT Subway is under Nassau Street on the west side and the IRT Subway is under William Street on the east. Exactly in the center of the lot, east and west, were the foundations of the old Mutual Life Insurance Building, constructed in 1902. This was the second building in the city to have exterior walls placed on pneumatic caissons carried down to rock. Of course these old caissons were difficult to remove, especially along building lines.

Because of the subway construction and the deep foundations of the Mutual Life Insurance Building, practically all the buildings in the area had been underpinned at some time, mostly by piles of 14-in. steel pipe jacked to rock or hardpan, cleaned out, and filled with concrete. In some cases, cast-iron cylinders of 36-in. diameter had been jacked down under the existing buildings. In the area immediately adjacent to the IRT Subway on William Street and off the former Cedar Street there were a great many wood piles under one of the old buildings. All these obstructions made excavation more difficult.

General excavation down to El. 2.5 which is just above ground-water ele-

FIG. 2. Section through exterior wall at one side of structure shows provision for cross-lot bracing.

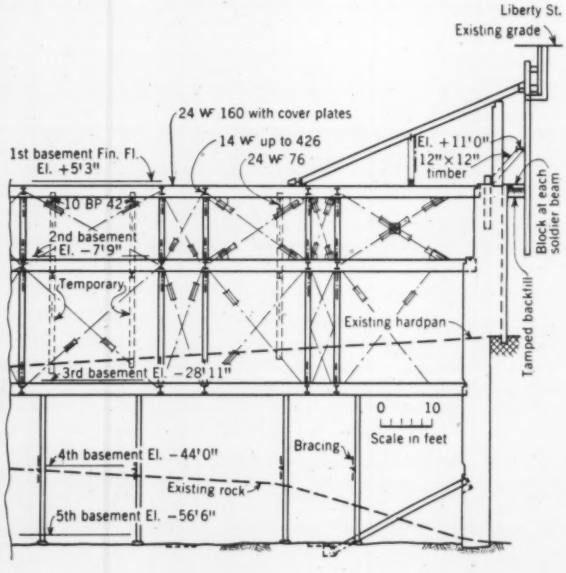


FIG. 3. Cross-lot bracing includes very heavy members that will become part of structural frame of the five basements under Chase Manhattan Bank Building.

vation, was done with power shovels. The entire area was mucked out except along the bordering streets where berms were left. Old caissons, outer basement walls, basement floors, and footings were blasted to break them up. When El. 2.5 was reached, the streets were protected by soldier beams driven approximately on the building line and connected by breast-boarding.

As the berms were removed, the soldier beams and breast-boards were braced by wood struts held against the soil at about El. 0.0.

After the perimeter of the lot had been protected and streets and subways braced laterally, the next step was to get the outer walls down to and keyed into rock. Interlocking steel sheetpiling was driven in a series of boxes around the perimeter of the lot, starting at the west end. After the sheeting had been driven through the varved silt down to and into hardpan, the silt was excavated and the sheetpiling braced with steel wales and struts. When hardpan was reached, alternate boxes were continued down by soldier beams and breast-boards.

Some strata in the hardpan are waterbearing and, especially at the eastern end of the area, a considerable depth of sand and gravel under the hardpan carries full hydrostatic head. Special chemical means to consolidate this is described below.

When rock was reached, its excavation was carried out by line drilling using quarry bars and air drills. The rock was then blasted with small charges of dynamite and hand mucked. During the excavation done in the sheeted boxes down to rock, a small amount of water was encountered. This was removed by air-pumps discharging into the city sewer system. Air to run the pneumatic tools—driving hammers, pulling hammers, pumps, and the like—was furnished by a battery of 600-cfs and 900-cfs air compressors.

During the driving of sheetpiling, demolition work below street level and blasting, a very accurate record was made of vibrations. This was done to provide a record of movement and to assure that no damage could result to adjacent property. As the sheeted boxes reached firm rock, forms were placed inside them and the exterior building walls were concreted in several lifts.

At the east end of the lot, where exploratory borings had shown the worst soil conditions, an experimental pit was installed in an effort to reach rock with an open cofferdam. This attempt was not successful. The test pit was started at El. +17, where 40 ft AP-3 sheetpiling was set around

Drill rigs from several sources were used to install casing of 5½-in. diameter. Chemicals to solidify granular soil were pumped through pipe installed inside casing.

Bracing holds BMT Subway under Nassau Street while adjacent area is excavated to rock.

Typical of well-braced cofferdams is this sheetpile box at southeast corner of lot.

Pipes were installed about 18 in. on centers, in two rows, to carry "two-shot" chemicals for soil solidification. Casing pipe is in foreground.

a 10-ft 9-in. square frame and driven into hardpan at El. −21. No difficulty was experienced in digging out the "bull's liver." Excavation into hardpan was first tried with breast-boarding, but when a small flow of water and silt indicated caution, a second ring of steel sheetpiling was set inside the first, around a 6-ft 10-in. frame. This sheeting was driven into hardpan with great difficulty from El. −39 to El. −46, and excavation was continued in the pit to El. −41, the sheeting being driven ahead, followed by excavation. At this elevation water and a small amount of sandy soil came into the excavation, warning of trouble. Also boulders were encountered, embedded in the hardpan. It was evident that removal of the boulders would permit further movement of soil from outside the excavation. For this reason the attempt to excavate this test pit was abandoned and the pit partially backfilled.

Soil solidification (the Joosten process) was tried around the test pit before excavation for walls at the eastern end of the lot. This was done by drilling 12 holes around the upper sheetpiling, into which sodium silicate was pumped, followed by an intrusion of calcium chloride. These chemicals, when mixed in the ground, precipitate and form an insoluble crystalline solid that solidifies granular materials. The test was made to see if the soil could be solidified to an extent that would permit excavation to rock in the open. It was successful. Rock was reached by use of breast-boards only, a convincing demonstration that chemical solidification could be profitably used.

For the general area, procedure was as follows: Two rows of holes were drilled around the outer perimeter of the eastern section of the lot just outside the steel sheeting line. Some 300 holes were drilled in two staggered lines with the holes about 18 in. on centers. The theory was that when

Local intrusion of chemicals was used successfully to seal flow in isolated areas where required. Note manifold for two chemicals and air.

solidification chemicals were injected into the soil they would penetrate out from the drilled holes about 2 ft radially, thus forming a somewhat continuous solidified wall around the entire eastern periphery of the lot.

The holes were drilled down to and about 6 in. into rock by truck-mounted rigs using Hughes bits. A 5½-in. casing to hold out the silt and sand was installed down to hardpan. Through the hardpan and down to rock the casing was 2⅞ in. in diameter. No solidification was used on the lot side (inside) of the steel sheeting. When the holes were ready for injection, a 1⅝-in. O.D. pipe was lowered to rock inside each casing and the casing was removed. A pressure of 150 psi was used to inject chemicals by the "two-shot" method. First the sodium silicate was injected, then this was solidified by an injection of calcium chloride.

Each time a shot was pumped into the soil the injection pipe was withdrawn a foot or two, and the process was then repeated. There was enough foreign material around the injection pipe to seal it into the hole so that the chemical penetrated into the surrounding soil instead of rising. The amount of material pumped into the soil varied from hole to hole, depending on the character of the immediate soil and its ability to absorb the chemicals. In the sandy soil, where the greatest trouble had been expected, large amounts of the chemicals were effective in penetrating the soil and setting it in a solid mass.

After the chemical grouting had been completed the boxes at the east end of the lot were excavated in the same manner as those at the western end. The operation was a complete success, with only minor difficulties encountered in excavating to rock. In two areas where chemical grouting was not used some movement of sand developed as the excavation was being carried down. Chemical grouting was also used locally to seal off trouble spots. Total loss of ground on the entire job has amounted to about 5 cu yd.

Chemical solidification proved very successful on the project and demonstrated beyond doubt that the process has merit in aiding in difficult excavation such as was experienced on this job. A subcontractor, the Chemical Soil Solidification Company of Chicago, was employed to do the chemical injections. A great deal of personal skill and "know-how" must be employed in the use of chemical grouting because there is no known way of checking exactly what has happened in the soil. A man skilled in the use of the chemicals and their application can tell by "feel" when he has accomplished his purpose. One of the advantages of using the "two-shot" method is that immediately upon contact the two chemicals react and there is no time lost waiting for solidification.

As the boxes for the exterior walls were firmly founded on solid rock, forms were set within the boxes and concrete walls were poured. Pockets were formed in the walls to accommodate the sets of cross-lot bracing at three levels, designed to become part of the permanent steel framing for the area below street level. These members (24-in. WF 160 with 14-in. by ½-in. cover plates cross-lot, and 14-in. WF up to 426 lb the long way) are supported on steel piles driven to hardpan. See Figs. 2 and 3.

The supports are extended down to the lowest elevation as excavation requires. Because no movement can be permitted in the exterior walls, the cross-lot bracing members are to be stressed by sets of four 300-ton hydraulic jacks per pair of beams. Many interesting engineering problems are involved in this process alone, especially with members 400 ft long running from Nassau to William St. The compression of the members must be controlled so that movement will not displace the steel. Hot sun and cold weather also have to be provided for in a way that will prevent either overstressing or understressing. Because of the deformation that will take place the stressing jacks will be placed in both ends of the steel members.

Temporary members between the sets of permanent bracing must be accurately placed so that the full strength of the members will be effective. All the temporary bracing will be removed as the permanent building steel is put into place.

Working space on this job is so limited that three large steel pile-supported trestles will be built out into the excavation from Liberty Street, the only available access street. The support piles for these trestles also will have to be carried down to the bottom of the excavation as it proceeds. However, the engineers have designed the cross-lot bracing and its temporary lateral and vertical bracing in such a manner that after the first two sets are in place and braced they will form a truss that will span about 60 ft, giving some working space for the final hardpan and rock excavation.

Skidmore, Owings and Merrill are the architects for the entire project. Andrew Fischer, Jr., A.M.ASCE, manages the construction for the Chase Manhattan Bank. The foundations were designed by Moran, Proctor, Mueser and Rutledge, with William H. Mueser, M. ASCE, and Robert C. Johnston as the firm's representatives. The superstructure design was done by Weiskopf and Pickworth.

(This article is based on a paper prepared by Mr. Cambell for the ASCE Convention in New York, to be presented at a Construction Division session presided over by Walter L. Couse, a member of the Division's Executive Committee.)

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HYDRAULIC BUTTERFLY VALVES

To obtain information on the butterfly type of valve used in hydroelectric, water works, and modern steam powerplant installations, questionnaires were mailed to eighty manufacturers and users of this type of equipment. Users reported on 1,100 valves, and the following discussion is based on a study of their reports, many of which required much time and effort in preparation.

Valves for hydroelectric service

Butterfly valves for hydroelectric service include those installed at inlets to turbine casings, as well as at the upper ends of penstocks. These valves normally operate in the wide-open position, and most of them can be closed under full penstock velocity, serving as emergency shutoff valves as well as isolating valves. They vary in diameter from 42 to 324 in. (27 ft) and operate under heads as high as 1,132 ft. Twenty valves of from 56- to 108-in. diameter operate under heads in excess of 700 ft, and eight valves of from 56- to 84-in. diameter, under heads in excess of 1,000 ft.

We also find butterfly valves used as free discharge valves, in some cases as regulators, functioning in the partially open position. Sixteen valves of this type, most of them between 60 and 96 in. in diameter, are functioning satisfactorily under heads of 65 to 294 ft. Others are used as guard valves for free-discharge valves of other types, and one was reported as functioning as a headgate at the inlet to a tunnel. Three high-head plants (over 1,000 ft) have butterfly valves at turbine inlets, as well as in branches of the penstocks adjacent to the turbines, where they serve as guard valves for the turbine relief valves and where they must close under double the velocity at the turbine casing inlets. Sixteen users reported on 330 valves in hydroelectric service.

With low velocity and low head, such as are found at the upper ends of penstocks, where valve diameters are large and disks are comparatively thin, cylindrically shaped bodies are used. To compensate for the presence of the open disk in the stream, body diameters are often made slightly larger than that of the penstock. Short tapered penstock sections connect to the valve body. For the higher velocities that are present where penstock connects to turbine casing, and particularly for high-head plants, it is customary to introduce a tapered section between valve and casing, all or part of which may be in the body itself. This results in uniform acceleration of flow through the valve with the thick open disk in the stream, and minimizes hydraulic losses.

About 85 percent of the bodies reported are of cast steel, cast iron being used for a few, as well as bronze for some small butterfly valves used as bypass valves on larger valves. Bodies as well as disks are of split construction when, because of their size, transportation facilities or other considerations require it. Large bodies are reinforced with exterior ribbing, and have extension pads or feet for mounting on a concrete foundation. Tapered flanges are sometimes used to facilitate removal of the body from the penstock, although no instances were reported of valve bodies being moved

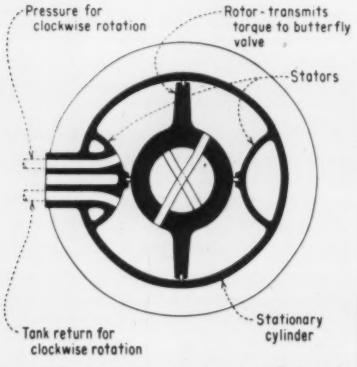


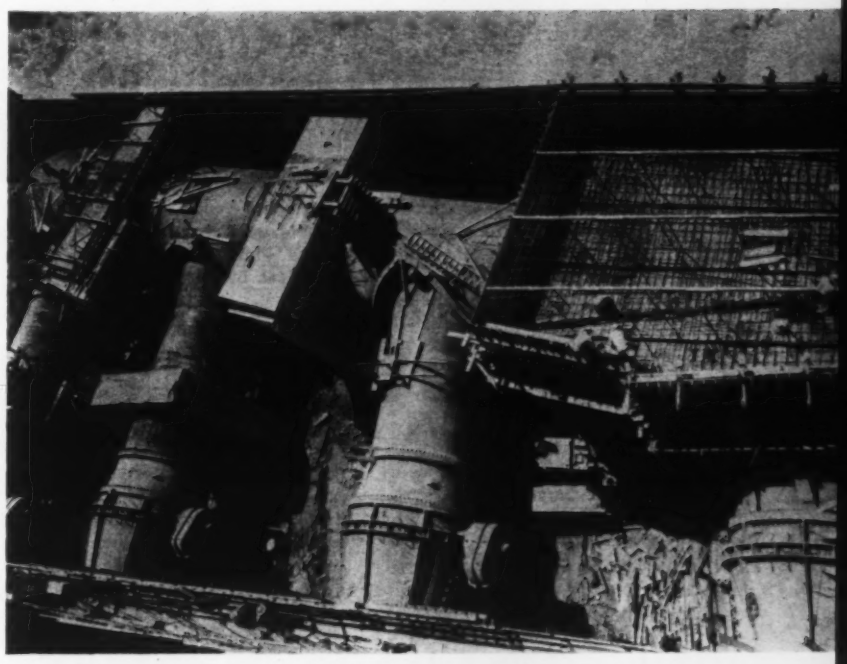
FIG. 1. At Hoover Powerplant, Bureau of Reclamation project on Colorado River, butterfly valve of 14-ft diameter is operated by hydraulic-rotor torque-drive unit invented by late P. A. Kinzie, standing on platform. Some 16 of these operating mechanisms (seen in Fig. 1) have given excellent service on turbine-inlet butterfly valves under 480-ft head at Hoover Dam over period of 20 years.

—dependability and low cost shown by survey

out of position after once being installed.

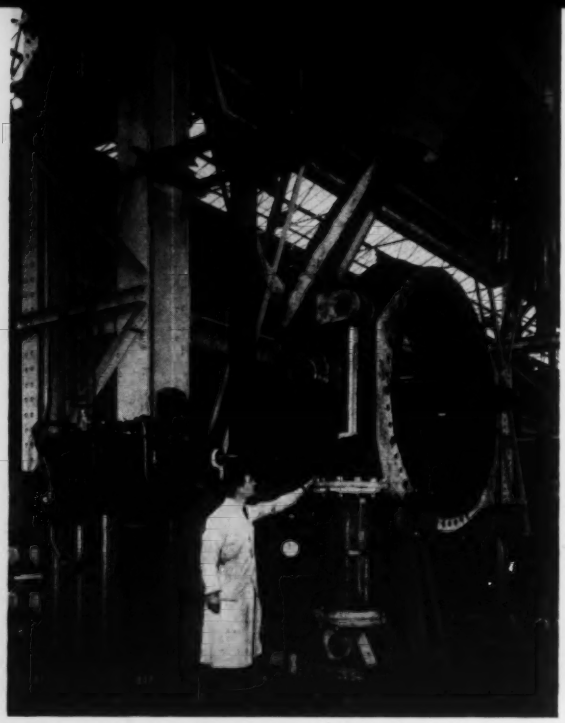
Disks are usually lens shaped, with smooth external surfaces. Under high heads the disk becomes quite thick where the heavy transverse shaft is located. Proper streamlining of the disk surfaces reduces hydraulic losses. Disks are usually of the same material as bodies, and have internal ribbing.

Shafts are usually made of forged steel, in a single piece, extending through the disk, and out through both bearings, with one end extended for connection to the operating mechanism. This tends to equalize hydraulic thrust. The ends of the bearings, projecting into the disk, are usually depended on to keep the disk properly centered. However, as both vertical and horizontal shafts are in general use, an external thrust bearing must be used on large valves with vertical shafts. One user suggests that it should be located on top of the valve body to avoid damage to the lower packing from any leakage through the lower shaft gland. Instead of a single shaft, two stub shafts, one at each

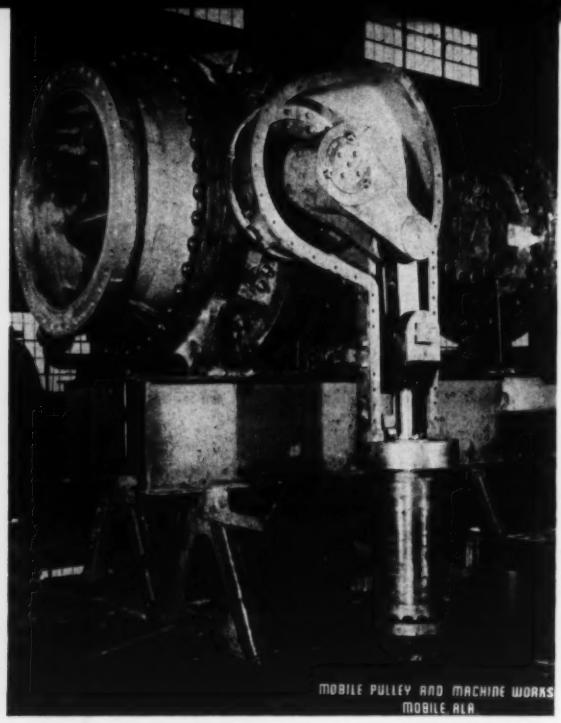


Butterfly valves of 15½-ft diameter were installed in 1953 at inlets to four turbine units in Palisades Power Plant, Idaho, under 241-ft head. Designed by U. S. Bureau of Reclamation, they have renewable bronze seat rings with adjustable ring in body.

Butterfly valve of 27-ft diameter is one of several built in 1927 for Conowingo Development of Susquehanna Power Co. for operating head of 89 ft. It is seen being assembled in shop of I. P. Morris Corp., now Baldwin-Lima-Hamilton Corp. In 30 years of operation, concrete surrounding these valves has swelled and forced bodies out of round by ¾ in. on the diameter. Concrete is now being chipped away to restore circular shape.



Of special interest is heavy weight, tripped by remote control, which closes this 7-ft-diameter butterfly valve built for 220-ft head by English Electric Co. for Hirfanli Plant in Turkey. Disk and body are of welded fabricated steel. Stainless steel seat contacts rubber ring on disk.



Typical piston drive operates the two butterfly valves at Bureau of Reclamation's Eklutna Plant in Alaska. Valve diameter is 5½ ft, head 820 ft.

side of the disk, are sometimes used on valves of large diameter.

Operating mechanisms are of many types and designs. Small valves may have these arranged for manual operation only. Larger valves and those requiring quick closure require powerful mechanisms, many of which are electric-motor driven with spur, bevel and worm gearing. Motors are usually located above the valve. Hydraulic operating mechanisms are preferred by many users, as water under pressure can be taken directly from the penstock, and is always available when electric current may be lacking in an emergency. The force created by either electric or hydraulic mechanisms is transmitted by a threaded spindle and operating nut, or by a piston rod to a heavy lever mounted on one end of the butterfly-valve shaft, rotating about 90 deg to move the disk from open to closed position. Some mechanisms utilize an oscillating nut or hydraulic cylinder with threaded stem or piston directly attached to the outboard end of the lever, while others employ a fixed nut or cylinder with a crosshead and guide, and linkage to the lever.

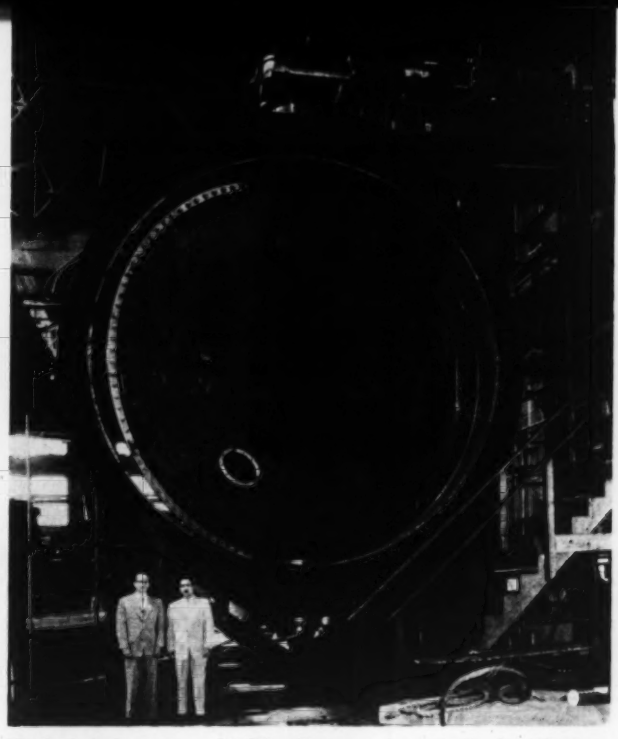
Auxiliary manual operation is obtained by introducing a hand wheel and gearing with a clutch as a part of the electric operating mechanism. A hand pump or a separate source of pressure-water supply, provides for auxiliary operation of a hydraulic operating mechanism when penstock pressure is not available. Some hydraulic operating mechanisms make use of pressure oil from an accumulator tank equipped with an electric-motor-driven pump. Such an arrangement insures operation when electric current is interrupted, and is particularly desirable in locations remote from the powerhouse or when penstock pressure may become too low to insure positive valve closure in an emergency.

Gearing and hydraulic cylinders are usually mounted on the concrete foundations adjacent to the valve body. Some prefer to mount the hydraulic-drive units directly on the valve, thus transmitting the reaction forces to the body without requiring heavy concrete anchorage and reinforcement.

An interesting variation of the hydraulic operating mechanism is the hydraulic rotor torque-drive unit designed by the U. S. Bureau of Reclamation (Fig. 1). Some 16 of these have been in operation and have given excellent service on the turbine-inlet butterfly valves at Hoover Dam for a period of 20 years. They have the disadvantage of high cost due to the use of metal seals. A rectangular oscillating piston rotates in a two-compartment cylinder located on top of the valve body. It is believed that its seals could be redesigned, based on the O-ring principle, materially reducing cost of future units.

There are also instances of using a heavy weight, whose fall, when triggered, closes the valve, with a hydraulic cylinder to cushion its drop, and to reset the valve in the open position. Automatic closing devices, such as paddles introduced into the penstock, or opposed pitot tubes, have been used to insure automatic closure in the event of excessive velocity such as that caused by a ruptured downstream penstock or turbine casing. When hydraulic operating mechanisms are used, provision is often made for a mechanical stop, arranged to lock the butterfly valve disk in the closed position.

Practically all hydroelectric butterfly valves of modern construction incorporate metal seal rings in their design. These are replaceable, and consist of narrow rings of bronze, stainless steel, or monel metal, set into grooves in both body and disk. One of them, either on disk or body, is usually adjustable, to compensate for any variation from true circular shape of body at the time of installation, and



Vertical-shaft valve of 17-ft diameter was built for Mexican Government by Baldwin-Lima-Hamilton Corp. Adjustable bronze seat ring on disk contacts renewable bronze ring in body. Note hydraulic operating mechanism on top.

to permit taking care of wear or cavitation after long use. Most of the valves reported are so equipped, and there is no record of the rings having worked loose.

Ratio of adjustable disk rings to adjustable body rings appears to be about 3 to 1, although the adjustable body ring, with bolts and jackscrews operable from outside the body, is preferred by some users as a disk adjustment can be an unpleasantly wet operation inside a valve with full pressure against the upstream disk face. Narrow flat seating surfaces are used, and the narrow contacting ring faces are usually finished at an angle of 10 to 15 deg with the valve axis, with the disk at 90 deg to the valve axis. Only 45 adjustments of metal seat rings were reported for 330 valves, some of which had been in continuous operation for 30 years or more.

Even with metal seats of the best design, some leakage is unavoidable, hence drain openings with suitable valves are located at the lowest point of the valve body, turbine casing, or penstock, downstream, and of sufficient diameter to dispose of the leakage. Table I gives a list of valves of different diameters, with leakage in gallons per minute under heads up to 1,155 ft for butterfly valves with adjustable metal seat rings. Number and diameters of drains and bypass valves are shown when given in the reports.

In hydroelectric practice, butterfly valves, with the exception of those used for free discharge, are provided with bypass valves. Their use permits slow filling of the empty downstream turbine casing or penstock. Needle-type bypass valves are preferred for high heads, and ordinary gate valves perform satisfactorily under the lower heads. Plug-type valves are sometimes used. A bypass, therefore, functions as a small free discharge valve.

One interesting case was reported where needle-type bypass valves of 11-in. diameter under 480-ft head became inoperable, the water having caused formation of a thick scale which filled the clearance spaces around the needles. They were replaced with small butterfly valves, which have been entirely satisfactory.

Operation of these bypass valves, which are usually located above the butterfly-valve body to avoid collection of sediment, may be by manual, electric, or hydraulic means, the latter two permitting of remote control. To insure the use of a bypass to fill an empty turbine casing or penstock, and thus equalize pressures before opening the main butterfly valve disk, a hydraulic operating mechanism for the main valve can be arranged to take pressure water for the opening movement of its hydraulic cylinder from casing or penstock on the downstream side of the closed disk.

TABLE I. Hydroelectric-type butterfly valves

Data on leakage, drains, and bypasses

Butterfly Valve Diameter, in.	Leakage Test Pressure, ft	Leakage gpm	Drain Valves No. and diam.	Bypass Valves No. and diam.
216	168.5	18	1-4″	1-14″
192	575	30	1-4″, 1-8″	1-12″
192	575	70	1-8″	1-12″
192	575	45.4	1-8″	1-12″
186	241	30	....	2-8″
182	380	22	1-8″	1-12″
180	150	65	1-12″	1-12″
174	171	25	....	2-6″
168	128	15	....	2-6″
168	635	50	....	2-12″
168	330	20	1-24″	....
165	634	35	1-4″	2-12″
157	173	20	....	2-6″
156	145	12	1-8″	1-6″
120	635	25	....	2-8″
120	157.5	15	1-8″	1-10″
120	420	9	1-10″	1-10″
117	634	35	1-4″	2-12″
117	420	7	1-10″	1-10″
108	200	20	....	....
108	200	20	1-8″	....
108	485	30	1-12″	....
102	128	8	....	1-4″
100	578	20	....	2-4″
96	1000	60	1-8″	1-8″
96	160	20	....	....
90	196	1	1-10″	1-10″
84	600	25	....	2-4″
84	82	10	....	....
84	1155	30	....	1-6″
78	820	19	1-8″	1-6″
78	830	20	1-10″	1-10″
78	330	19.7	....	....
76	346	10	....	....
76	290	10	....	....
72	355	20	1-8″	1-8″
72	230	6	1-4″	1-4″
66	820	25	....	1-4″
60	811	25	1-6″	1-8″
56	820	8.3	1-8″	1-4″

Valves for water works and steam powerplants

In water works and steam powerplants we find butterfly valves performing a wide variety of services as shown by reports submitted by 15 users of well over 700 valves. Diameters are in most instances within the

range of 6 to 96 in., and the operating heads largely within the range of 10 to 300 ft. One manufacturer reported production of 10,000 butterfly valves of water works type, ranging in diameter from 4 to 96 in., about half of which were in the 24- to 42-in. diameter range. Ninety percent of this production includes valves designed for 25-psi and 50-psi service, and less than 10 percent for 125-psi service. However, special valves, such as are found in hydroelectric service, appear in some of the larger pumping plants and dams used in transmitting and storing water in a few of the large water supply systems in the West.

Butterfly valves find use in modern water works systems as shutoff or isolating valves, check valves on pumps, altitude valves, pressure regulating and throttling valves, flow regulators and free-discharge valves. One water works engineer states that the butterfly valve is an excellent operating valve and is rapidly replacing the gate valve in many areas of water works practice. Two engineers tell of the advantages of using butterfly valves to isolate pipeline breaks because of their ease of closure under high velocity, and state that their ease of operation and low maintenance cost have made them highly satisfactory.

One water works system reports the installation of six 48-in. butterfly valves at different elevations in the outlet tower of a large reservoir, some under 150 ft of head. Another outlet-tower installation includes seven 54-in. butterfly valves replacing older-type sluice gates. Larger filter and water-treatment plants also provide a field for these valves, one plant reporting 22 of them, of 12-in. to 48-in. diameter; another, 10 of 16- to 36-in. diameter; and another 24 of 18-in. diameter.

Turning to modern steam-electric power plants, we find many butterfly valves used in the condenser-cooling-water circulating systems. One company reports 33 of them in 8 plants, of 36- to 96-in. diameter. Another shows 162 in 7 plants, of 54- and 66-in. diameter. They are located at the pump discharge and at inlets and outlets to condensers, and the outlet valves function in the partially open position as discharge regulators.

In general, we find pressures lower, velocities lower, and valve diameters less, than for valves used in hydroelectric service. Likewise there is a potential market for the water works type of valve that greatly exceeds that in the hydroelectric field. As a result of this situation, a committee of the American Water Works Association, made up of representatives of both manufacturers and users, has in the past few years formulated and published a complete set of Tentative Standard Specifications on both metal-seated and rubber-seated butterfly valves covering a range in diameter of from 3 in. to 72 in. Rubber-seated valves are classified for 25-, 50- and 125-psi service, and metal-seated valves for 25, 50, 100, 150, and 200 psi. There is also a further classification as to maximum velocities of 8 and 16 fps for rubber-seated valves, and 16, 25, 35 and 60 fps for metal-seated valves, as well as for free discharge under the different specified pressures.

Face-to-face length of body, flange thickness, minimum body shell thickness and minimum shaft diameter are specified, as well as minimum operator torque for most adverse conditions and minimum seat thickness for the rubber-seated valves. Requirements for the design of the different parts are given, including manual, electric, hydraulic and pneumatic operating mechanisms, as well as for shop performance, leakage, and hydrostatic tests on the valves themselves. The work of this committee has already gone far toward standardizing and simplifying the manufacture and purchase of this type of equipment.

Normal body design is cylindrical and the axial length varies from over twice the diameter for very small sizes, to 25 to 60 percent of the diameter for the larger valves, depending somewhat on the operating pressure. Foundation feet or brackets are rarely used, the body being supported by adjacent pipe sections. Bodies may be of cast iron, cast steel, or fabricated steel and are normally flanged for connection to adjoining pipe. The internal surface of the body is machined to receive metal or rubber-seat rings, and machined hubs or housings are cast or fabricated integral with the body to receive the bearing sleeves. The standard specifications require stainless-steel shafts which may be made in a single piece extending through the disk, or may consist of two "stubs" inserted at each side of the disk. In any case, a bearing must be located out beyond the stuffing box gland at the end of the shaft which connects to the valve operator.

Shafts are usually located with their axes either vertical or horizontal, are provided with suitable thrust bearings or surfaces to center the disk, and are fixed to the disks by keys, dowel pins, or taper pins. Disks are normally of cast iron, cast steel or fabricated steel, lens shaped, and with internal ribbing. Valves may be buried in the ground, not requiring concrete valve pits.

Two types of seats, rubber and metal, are used in these water-works-type valves. In the rubber-seated valve, a ring of rubber of specified thickness is cemented or vulcanized to the body at the point where the disk seats against it. It is sometimes set into a machined groove in the body, and either clamped in place by metal segments, or extended to cover the interior surface of the body and flanged at each end to form gaskets for the body flanges, thus serving to clamp the rubber spool-shaped ring in place. Rubber rings may be reinforced with fabric and may be used with disks that seat at 90 deg or at an angle. In the latter case they must be wider than for 90-deg seating. The seating edge of the disk is required to have a covering or facing of stainless steel, monel metal, or bronze. Sprayed metal seating surfaces are not permitted.

In the metal-seated valves, bronze, babbitt or monel seats are required and are normally attached to the valve body, and disks are provided with seating edges of stainless steel, monel metal, or bronze. Disks may seat at 90 deg or at an angle, sprayed metal seats are not acceptable, and disks with stainless-steel seating edges are not permitted when body seats are of bronze. Adjustable mechanical stops are used to prevent overtravel of the disk and to properly center it in both closed and open positions. Adjustable metal seat rings are seldom if ever used. Seating surfaces are normally applied by welding instead of by mechanical attachment with screws or bolts, such as we find in the butterfly valves designed for hydroelectric service.

Operating mechanisms are of the manual, electric, hydraulic, or pneumatic type, depending on the type of service required. Automatic controls are in general use, particularly for such types of service as check valves on pumps, flow and pressure regulators, and altitude valves.

Rubber-seated butterfly valves are so constructed that no leakage whatever occurs through them when closed. Seats are replaceable at the site of installation. The standard specifications for metal-seated valves contain a table listing maximum permissable leakage for valves of different diameters under different pressures.

Tests and repairs

For all types of butterfly valves certain shop tests are usually specified. A hydrostatic test is required under a pressure of from 150 to 200 percent of the operating head for valves used in hydroelectric service. The standard hydrostatic test pressure for the water works type is 200 percent of the specified shutoff pressure. Leakage tests are also required to determine whether leakage between closed disk and body

under operating pressure comes within the specified or guaranteed amounts. For rubber-seated butterfly valves, the body is placed with flange faces horizontal, disk closed, and upper surface of disk covered with a pool of water under no pressure. Air pressure equivalent to the operating pressure for which the valve is designed, is built up under the disk, and no leakage is permitted as evidenced by rising air bubbles in the water on top of the disk. Performance or operating tests are also carried out in the dry to demonstrate that the operating mechanism and other valve parts work properly.

For 330 butterfly valves in hydroelectric service over a period of 15 to 35 years, only 21, or about 6½ percent, have required any adjustments or repairs. Five of them, not provided with renewable or adjustable seats, required building up of seating surfaces, or scraping after 14 to 26 years of service. Of the valves with adjustable seat rings, two required adjustment on five occasions during an operating life of 25 years, and two had seat rings adjusted three times in an operating period of 31 years. A 72-in. valve in service 90 percent of the time for a period of 25 years under a 646-ft head was repaired four times because of excessive leakage. Bronze seats were built up and later replaced with stainless steel. Leakage was reduced from over 15,000 gpm to 15 gpm. Other valves required only one or two seat adjustments during 25 to 35 years of service, and no repairs whatever. Two 78-in. free-discharge butterfly valves, operated in a full or partially open position under a 270-ft head for a total of about 2,400 days since their installation 25 years ago, were repaired only once by welding cavitation holes in their seat rings.

For water works valves, one user reports replacement of rubber body seats on 4 of 33 rubber-seated valves in service 9 years, and replacement of one rubber body seat on a valve in service for 4 years. Another organization, with 35 rubber- and metal-seated valves, many in service for 20 years or more, reports no adjustments or repairs. Another large water works organization reports no repairs on 160 valves, and renewable metal-seat adjustments averaging once in 10 years of continuous operation.

Coefficient of discharge

A few of the reports submitted contained information on discharge coefficients. Such data as were received showed a variation between 0.65 and 0.845, with an average of 0.77, this being the ratio of actual discharge to the theoretical discharge of a full circular jet of a diameter equal to that of the valve outlet. The higher coefficient applied in general to valves operating under low heads where the disks were comparatively thin in proportion to the diameter. One report on a 78-in. free-discharge valve under a 255-ft head, shows a coefficient of 0.91, based on the net open area of the valve.

Instead of giving a discharge coefficient, several of the reports gave the head loss through their valves as being one quarter of the velocity head, or $H = K \frac{V^2}{2g}$, where H equals head loss in ft; V, velocity of water column in fps based on gross area of valve; g, the gravity acceleration of 32.2 ft per sec per sec; and K, a constant, usually 0.25.

A formula often used to calculate the flow through a free-discharge butterfly valve is $Q = CA\sqrt{2\,gh}$, where Q is the discharge in cfs; C, the coefficient of discharge (about 0.93); A, the net open area is sq ft; g, the gravity acceleration of 32.2; and h, the effective head (velocity head plus pressure head) at the valve in ft.

Torque for free-discharge valves

Tests on several free-discharge butterfly valves indicate that the maximum operating torque occurs when the disk face is at an angle of 25 deg with the valve axis, or 65 deg from the closed position. Greater torque is required for opening than for closing. The formula developed by E. A. Dow, M. ASCE, is often used to calculate this torque and is expressed as $T = K\,V^2\,D^3$, where T is torque in ft-lb; V, velocity in fps; and D, diameter of valve in ft. K seems to vary for different velocities but is often assumed as 0.10.

Engineers of the Pacific Gas & Electric Co. found a K value of 0.08 for a 78-in. free-discharge butterfly valve under a 278-ft head. Other tests indicated a lower value of K under higher velocities. They developed a formula, $T = V^{1.5}\,D^3$, in which bearing friction and loss due to the efficiency of the operating mechanism must be added in determining the total operating moment.

Conclusions

The hydraulic butterfly valve, when properly designed for a specific function in hydroelectric projects, as well as in water works and steam powerplant service, is an exceedingly versatile piece of equipment. It has held its position in the hydroelectric field for many years, where within its field of usefulness it has superseded other and more expensive types of valves. Its comparatively low initial cost, as well as low maintenance cost, and its favorable characteristics in relation to water flow and to different methods of operation, are very definitely in its favor.

These same features in the water works type of valve, combined with the simplification resulting from standardization, will undoubtedly result in a definite increase in its use in the next few years, for this type of service. It is suggested that designers in these two fields investigate the possibility of using valves of the butterfly type before adopting other, and perhaps more expensive types of valves to meet their performance requirements.

The writer wishes to extend his thanks and appreciation to the following who, by their willingness to devote considerable time and effort to answering his questionnaire, have contributed greatly to any value this article may have.

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W. C. BLOOM

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Financial management in construction

Dun & Bradstreet reports that 1,834 construction firms failed in 1956. These failures involved more than $100 million of unpaid liabilities, an increase of 30 percent over 1955. It is significant that they represent almost 15 percent of all business failures. The companies that failed, plus others that are at present on the road to failure, have caused a serious downward trend in profit margins in the construction industry. The 1953 tabulations of construction corporations, by the United States Treasury Department, show a net profit after taxation of only 1.5 percent, considerably lower than in 1952 when 2.4 percent was earned.

According to Dun & Bradstreet, the main reasons for construction company failures and adverse profit trends are:

1. The fundamental mistake of undertaking work for which the contractor lacks experience and knowledge.
2. Bidding on and accepting work with greater financial responsibility than the contractor is able to meet.
3. Record keeping that does not properly provide for current follow-up of the work in progress.
4. Inability to relate or otherwise understand cost information when it is made available.
5. Inadequate markup in pricing a job in relation to the total funds employed.

Note that of the five causes of failure, four are directly matters of *financial* management. Now let us consider the role of management's financial team.

First, it must be remembered that behind every business activity lies an investment of some kind, which is expected to show a profit. Second, someone must be responsible for this business function. The financial team, therefore, becomes the custodian of the invested funds, responsible for their profitable use and for a return on total funds employed.

There is nothing new about this. It is a time-tested method of measuring the effectiveness of management. Certainly if a contractor's return is not greater than that of a straight monetary investment, he is not being fairly compensated for the construction risks involved in his work, nor is he providing for a reasonable safety margin for cost overruns or other contingencies.

Briefly then, we must go one step further than the customary profit-to-cost index of the job and look at the relation of profit to total funds employed. To emphasize the several important factors which must be considered—such as home office expense, taxes on income, the relation of job cost to markup, and the relation of the amount of time that funds are needed to job cost—full equations for return on total funds employed are set forth in Table I.

In this era of specialization we are inclined to believe that these matters are for the sole consideration of the financial staff. In reality however, the engineer, the estimator, the project manager, and the job superintendent, those who directly use the company's funds, all are as much involved and concerned as the controller and his staff. In short everyone responsible for the company's work should comprise the financial management team.

Essentially there are three important elements in which all members of the team participate: the preplanned use of funds, the responsibility for their use, and their control during all stages of the job from award to completion.

The pre-bid meeting of this group, formal or informal as it may be, establishes the final planning for each project. Many of the basic causes of construction company failures originate at this point with little chance of later correction.

At the pre-bid meeting a consistent pattern of questions usually arises. These can be divided into two general categories. First, there are the questions which are meant to ascertain the cost of the permanently installed materials called for by the plans and specifications, plus the cost of the recurring daily operating expenses, such as labor, fuel, supplies and temporary facilities. A well informed estimating department is the best assurance that these costs will be fully recovered in the contract price. In the second category of questions are those which aid in setting the bid price for the work. Knowingly or not, these queries are the key to any successful business if a sound relationship is kept between sales, profit and funds employed. The questions most often heard are:

1. What will be the average job investment and how long will these funds be needed?
2. What is the recommended markup?
3. Will the resulting bid price place us in a favorable competitive position?
4. Can we be satisfied with a lower markup in order to meet competition?
5. What salvage value has been put on the construction equipment?

Too many times, however, prior to bidding, the answers to these questions are not properly related, one to another, to provide a common denominator—return on total funds employed.

Unless certain prior ground rules are established, decisions reached in this planning stage may be meaningless. For example, you must know what percentage return your company needs on the funds employed, before you can intelligently set the job markup. In the construction industry, over a period of years, earnings after taxes have averaged between 8 percent and 10 percent of total assets. Since almost 40 percent of all construction companies included in these percentages reported no taxable income, the returns for the successful ones must be con-

Table I. Equations for return on funds employed

$$\frac{(\text{Job markup} - \text{Home office expense}) \times \text{Income tax rate}}{\text{Estimated job cost}} = \text{Effective markup} \quad . . (1)$$

$$\frac{\text{Estimated job cost}}{\text{Total funds employed} \times \text{No. years needed}} = \text{Effective use of funds} \quad . . (2)$$

$$\text{Effective markup} \times \text{Effective use of funds} = \text{Percentage return on funds employed} \quad . (3)$$

Table II. Four examples worked out, in percent

Items	Examples A	B	C	D
Estimated cost	100	100	100	100
Job markup:				
Cash profit	20	10	4	10
Equipment profit	-	-	6	-
Funds employed	20	20	20	10
Time funds are needed, years	2.5	2.5	2.5	1.5
Home office expense	5	5	5	5
Income tax rate	50	50	50	50
Return per year on funds employed:				
Cash	15	5	1	15
Equipment	-	-	6	-
Return on funds employed at job markup level	100	50	50	100

siderably higher. This percentage return must be set by each individual contractor's requirements.

The source, availability, and cost of the funds needed should be given the same consideration that the survey team and estimator give to the source, availability and cost of aggregate or any other material. If funds must be borrowed, the team needs to know this so it can include the interest expense in the estimate. At the same time the contractor should determine the maximum total of funds he can make available, then pass up the expense of estimating on projects that add up to more than this amount.

Similarly a limitation should be placed on the proportion of job markup that will be returned in the form of residual equipment. It is extremely difficult, as some contractors have found, to pay salaries and Uncle Sam's share of the profits with a leftover crane or bulldozer.

In Example A of Table II, the results of a hypothetical pre-bid meeting indicate a cash return of 15 percent per year on funds employed after all home office expense and taxes on income are paid. In this example it requires a 100 percent return on funds needed at the job markup level of 20 percent.

In Example B, it was necessary to reexamine the markup, ultimately concluding that a competitive price could carry not more than a 10 percent markup. Merely by reducing the markup 50 percent, the return per year on the funds employed has been decreased from 15 percent to only 5 percent. This is dangerously low; it does not allow an adequate safety margin.

Example C is shown to stress the importance of the relationship of equipment cost and salvage value. In this instance, the contractor has used the same markup of 10 percent but is willing to take 60 percent of it in the estimated residual value of the equipment. As a result, in order to pay his home office expense and taxes, he must borrow money if he has trouble in disposing of the equipment or decides to retain it for future use. This problem is one that is often overlooked in properly setting the cost of equipment and its relation to job markup. Continuation of this policy can only lead to eventual failure, although during interim years it may appear profitable.

In Example D, the contractor has set a 15 percent target return per year on funds employed. To achieve this and still permit making a competitive bid at a 10 percent markup, the money needed is re-examined to determine if the amount can be reduced 50 percent and the length of time cut from 2½ to 1½ years. While this reduces the dollar profit, a corresponding downward adjustment in the required funds permits investment in other work so that the net dollar return will remain the same. On the other hand, if the contractor finds he cannot make adjustments to yield a satisfactory return, it may be to his advantage not to bid.

In order to avoid the hazards of bidding on every project as a basis for growth and expansion, I recommend that each job be examined to determine whether it will impair, maintain, or improve the overall company return on total funds employed.

Lack of a definite fixed responsibility for profit is one of the major omissions of the modern construction organization. The *estimator* knows he is expected to arrive at competitive prices to maintain a high contract volume and backlog. Likewise, the *project manager* knows he is expected to pace the construction of these projects with the estimated progress schedules. Both of these men must conduct their work so as to produce a profit. The blame for unsatisfactory results, often tossed from one to the other, can be largely eliminated if these two resolve their differences and agree on job progress, methods, and other conditions in the pre-bid planning phase. The final estimate then represents the agreed-upon goal of the financial management team and transfers profit responsibility to the project manager.

The project manager, therefore, must provide himself with in-progress control information. Complete and timely control reports of performance compared to the final pre-bid estimate are the only effective means of measuring financial progress. While there are many reports that are useful to the project manager the following are considered essential.

1. The *Commitment Report* is intended to show procurement performance as compared to the estimate. As procurement may run between 60 and 80 percent of total job cost, early and frequent reports of overrun in these costs can lead to substitutions or other cost-saving methods.

2. The *Progress* and *Labor Report* is intended to measure physical accomplishment of the major work items together with the work force required to reach the reported stages of completion, as compared to the estimate.

3. The *Interim Cost Analysis* is intended to examine the full scope of the project at various stages of completion, including cost and progress to date, with considerable emphasis on a comprehensive and objective forecast of the cost to complete.

4. The *Cash Flow Analysis* is intended to forecast the requirement for funds and to carry out the planned use of them within the limits of the estimate.

Information from such reports is valuable only if used. It is imperative that the reports be made available promptly after each cost period, that they be studied thoroughly, and that the indicated action be taken at once.

(This article is based on a paper to be presented by Mr. Bloom at a Construction Division session at the New York Convention.)

Contractors have different ideas on

FORMS FOR CABLE-SUSPENDED

Similar hangars, side by side at New York's International Airport (Idlewild), employ completely different methods for forming a folded-plate roof of post-tensioned lightweight concrete. On both these hangars the roof is cable-suspended from a central core to provide a structure some 400 ft wide and 630 to 816 ft long, with a completely open space 140 to 160 ft wide on each side, to accommodate a dozen of the largest planes.

There are many unusual things in the design and methods of construction of these hangars, but differences in roof forms are outstanding. The folded-plate roof design makes it necessary to lower the forms 6 ft to move them. Since the hangar roofs are 35 to 55 ft high, and there are 22 to 28 similar roof sections, traveling falsework is economical. Balancing the load on the two sides of the center section, and a rush schedule, have required four sets of forms for each structure.

The hangar for Pan American Airways is being built by Corbetta Construction Company, using timber falsework with an inclined rail system for lowering it 6 ft for clearance under the folded-plate roof. Nearby a similar hangar is being constructed by Grove, Shepherd, Wilson & Kruge, Inc., for the Port of New York Authority, to be leased to Trans-World Airlines. Forms for Grove were designed

Pan American Airways hangar

CHARLES J. PROKOP, Vice President, Corbetta Construction Co. Inc., New York

Pan American World Airways is establishing major base facilities at the New York International Airport. The main buildings under construction (all of reinforced concrete) are an office building, two wings, and a large hangar. Of this group of buildings the hangar is the most interesting from the construction point of view.

The hangar has a three-story center section 100 ft wide and 630 ft long, and a folded-plate, cable-supported, post-tensioned roof slab extending 130 ft from each side of the center section. Clearance under the roof at the hinge is 35 ft, rising to 53 ft at the outer end. The door arrangement extends the floor space to 140 ft, providing a total width of 380 ft for the hangars and center section.

Spanning the 100-ft-wide center section above the roof are 30-ft-high walls spaced 30 ft on centers that carry ties across their top for cables supporting the folded-plate hangar roof. These walls double as a beam to support the roof of the center section and make it possible to hang the second and third floors as desired. In part of the building the lower floor is left completely free of interior columns, the floor above being hung on rods from the wall overhead. In other areas, floors are supported on columns so that the third floor is open for storage. Some spaces between the walls above the center-section roof are enclosed for use as mechanical equipment rooms.

A tension tie across the top of each of the walls spanning the center section is made up of 24 bars, 1⅝ in. square, welded to two 2¼-in-thick anchorage plates at each end to receive the four 2¼-in. cables that support the outer end of the roof, post-tensioning the roof concrete. The folded-plate-style roof is corrugated about 5 ft 6 in. deep, with decks and valleys 9 ft wide connected with sloping sides at about 5 on 6. The deck, which is of lightweight concrete, is 4¾ in. thick. At supports the concrete is thicker.

After studies had been made of several methods of constructing a traveler to suit this type of construction, a method was selected based on the principle of two wedges. This is often used in construction as it permits the raising or lowering of heavy loads with a minimum of special equipment and materials. Four travelers were constructed of wood, fabricated and erected at the job site, each traveler to support a hangar-roof section 60 ft wide and 130 ft long. Each traveler has separate lower and upper wedge

HANGAR ROOF

by Timber Structures, Inc., using laminated timber beams with a hydraulic jacking system for lowering. A hangar of the same type was built by Kansas City, Mo., for TWA use, by MacDonald-Creighton of St. Louis and Nashville, using structural-steel falsework with hydraulic jacks for lowering, much as will be described for the TWA hangar in New York.

All three of these hangars have different dimensions and details to suit the ideas of the users but all follow the same pattern. A three-story central structure serves as office, shop and storage area for the hangar. Concrete walls on 30-ft centers above this central structure serve as anchorages for four cables of about 2⅜-in. diameter that connect to the outer edge of the roof to post-tension and support the cover over the hangar areas on each side. A tension tie across the top of the wall utilizes the pull at opposite sides, since both sides must be stressed simultaneously.

To make the entire hangar accessible, doors without posts roll on tracks along the front, so that any area can be entered. Since the doors run on several tracks, sections can be stacked to leave about two-thirds of the length open if desired. But the roof is flexible and its outer end moves vertically with load, temperature, and wind variations. The doors are vertical up to a point near the top, whence a horizontally hinged section slopes in to connect to the roof.

The various means used for forming these hangar roofs at Idlewild are here described. Each method has its advantages—and disadvantages. Within the organizations of the individual contractors there were differences of opinion as to what method would be fastest and most economical. Factors in selection were availability of materials, cost of design and fabrication, speed of moving, and salvage. Each method has produced satisfactory structures at comparable forming costs; each user would make some changes for another application.

sections, utilizing the inclined plane between them to gently lower the upper section 6 ft vertically to allow forward movement. See Fig. 1.

The lower section of the traveler has a width of 75 ft. Its top is an 8 x 10 timber carrying a 70-lb rail on a slope of 3½ on 12. Double-flanged wheels on the upper section, at four "carrying trusses" in the 130-ft length, match this rail to raise or lower the upper section by movement along an inclined plane.

When the traveling form is in working position the load is taken over by seven vertical columns in each of eight rows. Sills and wedges are used under the lower section. Along the plane of movement between the upper and lower sections, 56 screw jacks are utilized to lift the upper section about 5 in. off the inclined track and also support the work during concreting. Forms are brought to exact height by adjusting the jacks. Direct telephonic communication between the instrument party on the deck and the foreman of the adjusting crew at the jacks speeds the work.

Forms are of ⅝-in. plastic-coated plywood supported at about 18-in. centers to carry the 4¾-in.-thick concrete deck. Concrete is placed by an 802 Lima Crane with 100-ft boom and 30-ft jib, using a 1-cu yd Insley lay-down type of bucket. Concrete is purchased from a commercial transit-mix plant. A lightweight coarse aggregate (Lelite), using sand for the fine aggregate, gives concrete weighing a maximum of 120 lb per cu ft. Concrete is placed moderately dry (3-in. slump) and during vibration is held on the slope by a simple frame shown in an accompanying photograph. The frame is held 4¾ in. from the form by four legs fastened to the frame. Concrete is wood-floated and steel-troweled to a reasonably smooth surface, then water cured. Two 60-ft-wide sections, opposite each other on each side of the center section, are concreted. These two sections are then tensioned simultaneously to pick up the roof load.

At a spacing of 30 ft, four 2¼-in. cables are attached by pins to the anchor plates at the end of the tension bars at the top of the wall over the center section. The outer ends of the cables, with sockets attached, are pulled through sleeves in the valleys of the folded-plate roof. A bank of four hydraulic jacks is set up at four locations, two on each side of the center section, to tension 16 cables at one time.

When the concrete reaches a compressive strength of 2,500 psi, cables are tensioned by the jacks to lift the outer end of the roof 6½ in. Jacks are set up so that pressure can be applied to all cables or to any one for minute adjustment. Gages show the pressure on each jack. Shims are placed back of the socket on each cable to permanently hold the roof. An average tension of 176 kips on each of the four cables is required to lift the roof slab the desired amount. A maximum tension of 240 kips is permitted until forms have been released from the concrete.

Stripping of the forms is a by-product of the stressing. As the cables are tensioned, small wooden wedges are driven between the form and the concrete at the outer end and along the edges to start separation. Once started, the form peels off the concrete roof with little difficulty.

At the hinged end, movement caused by tensioning is very small. The supporting screw jacks are backed off

about 5 in. to lower the upper section of the form. Before the wheels come in contact with the inclined rails, the upper section is fastened to prevent movement by means of cables to a "deadman" (anchor) in the ground.

The lower "wedge" is controlled by the operator of an 802 Lima crane weighing about 60 tons, using the cable from one of its drums. This cable is reaved through sheaves to the required number of parts to control the downward thrust from the weight of the anchored heavy upper section, which has a tendency to drive the bottom wedge section ahead, thus lowering the top wedge vertically to clear the valleys of the roof slab. The upper and lower wedges are then locked to prevent further relative movement.

Cables to the anchor and the crane are released. With another hitch, the traveler is moved 60 ft to its next position. The anchor cables of the upper section are refastened to hold it against vertical movement. The crane is again used to pull the lower section back, raising the upper section vertically until the jacking posts are in line with those of the top section. Sills on the ground are placed and wedged under each jacking post. Screw jacks are reset between the upper and lower sections and the form raised to concrete placing position.

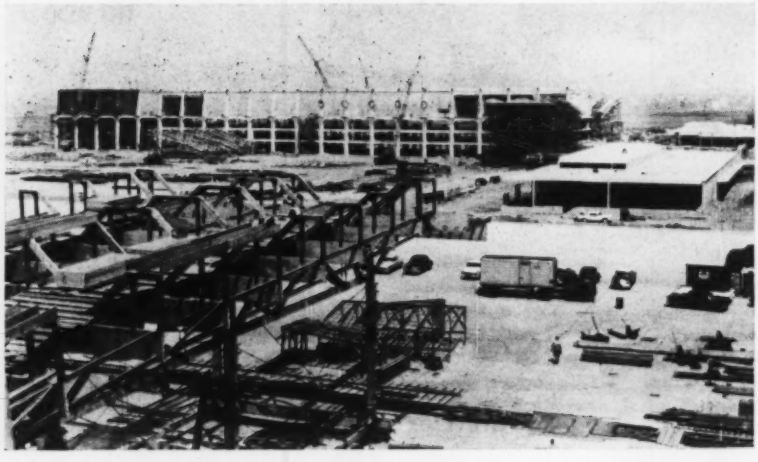
Cycle for a pair of forms

The cycle for a pair of forms is about two weeks from concrete placing to concrete placing. The construction cycle is as follows:

1 day:	place 170-cu yd lightweight concrete.
3 days:	curing. During this time eight cables are placed and eight 200-ton jacks are set ready for tensioning cables when strength of concrete has reached 2,500 psi.
1 day:	tension cables (both sides at the same time).
1½ days:	lower, move, and raise traveler and rebuild form for diaphragm.
2½ days:	install reinforcing steel.
1 day:	close up diaphragm forms and clean deck, ready for concreting.
10 days:	minimum working time required

The form looks big and cumbersome and it is. But it moves readily without breakdowns that would cause loss of time and does economically the job for which it was designed.

Architect-engineer for the Pan American World Airways hangar is Chester L. Churchill of New York, with Ammann and Whitney as structural engineers. The forms were planned by the Corbetta Construction Co., and the structural design was done by Herbert Fleischer.



Form designed by Timber Structures, Inc., for TWA hangar in foreground features glued-laminated structural members with rod diagonals. Forms under construction in background for PAA hangar utilize inclined-plane principle to lower upper section 6 ft so that it can pass under corrugations of folded-plate roof.

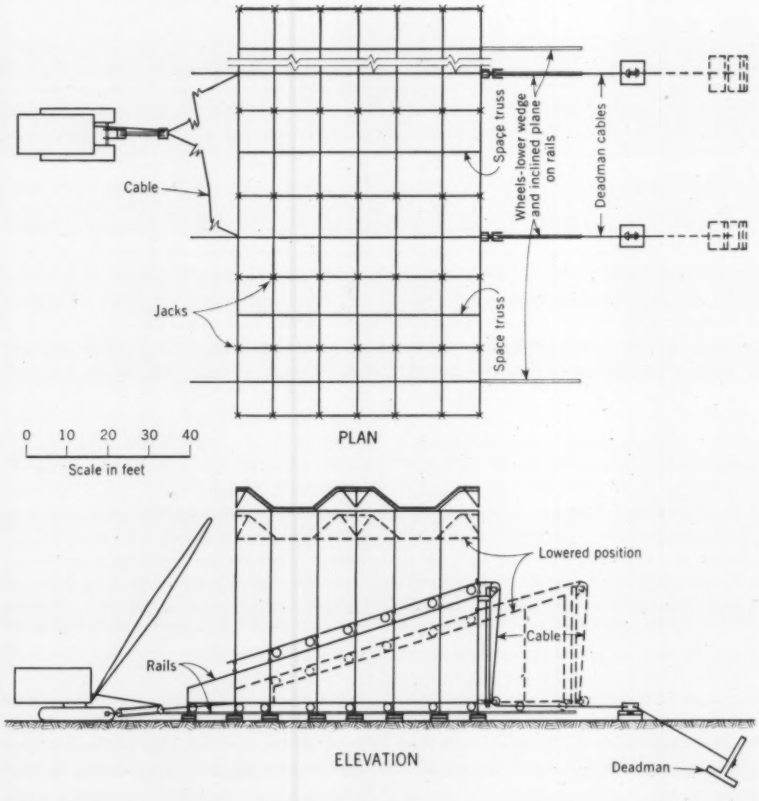
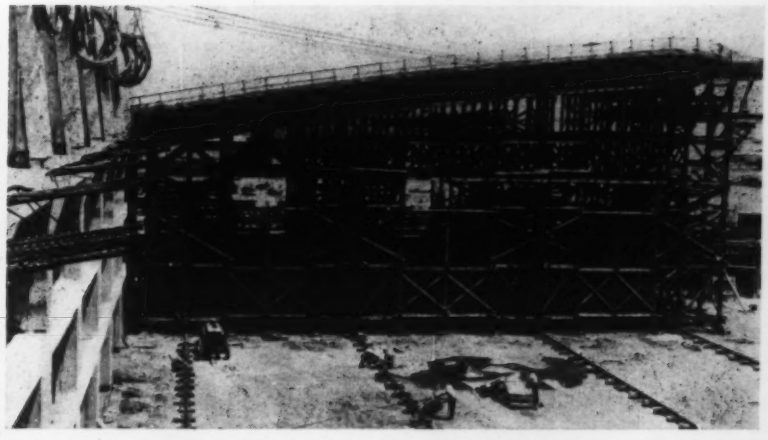
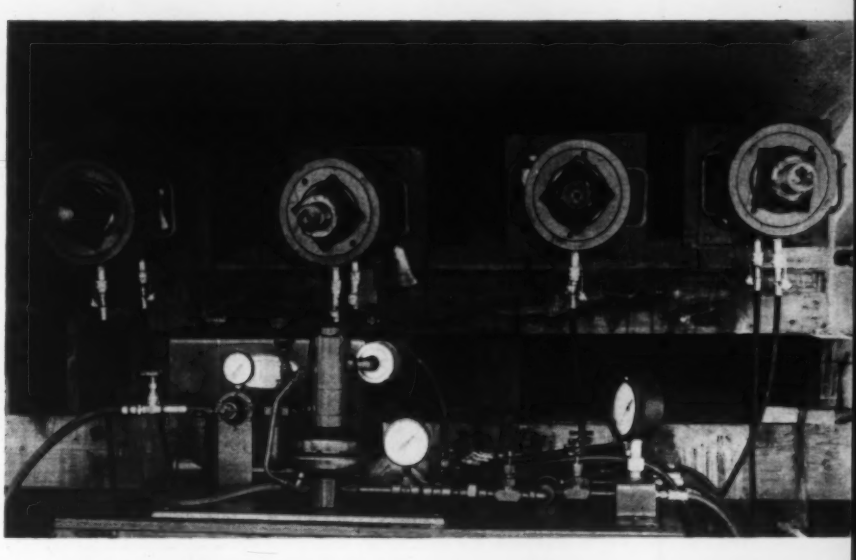


FIG. 1. Top section of form is rigged in such a way that it moves downward 6 ft as bottom section moves ahead.

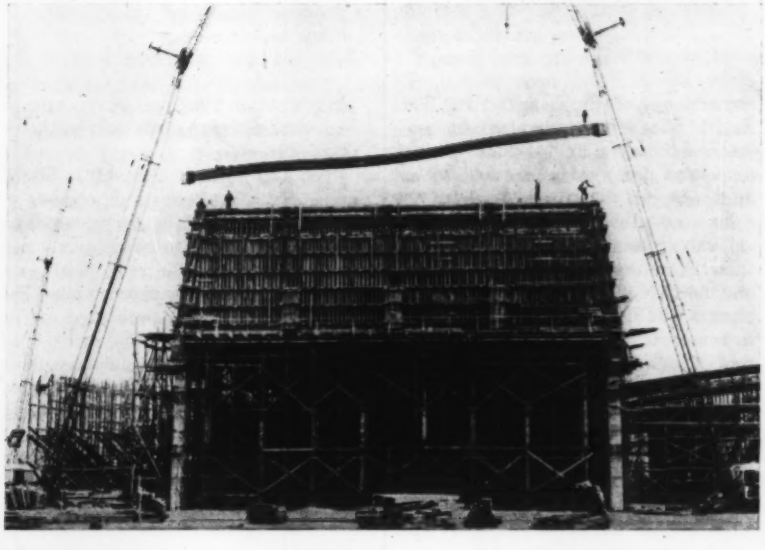
Simple frame holds dry mix of lightweight concrete on slope while it is vibrated for roof 4¾ in. thick.



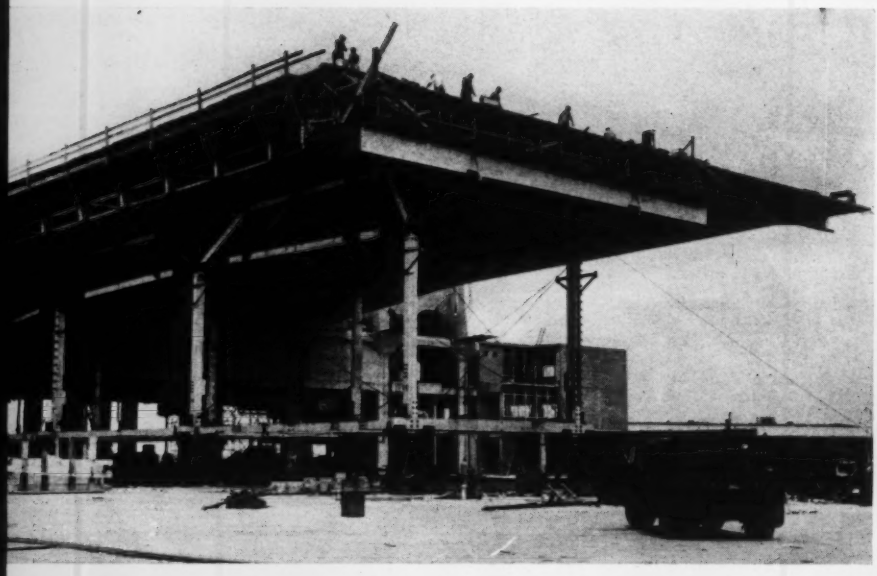
Each of four Corbetta forms uses 125,000 fbm of lumber, most of which can be salvaged for reuse.

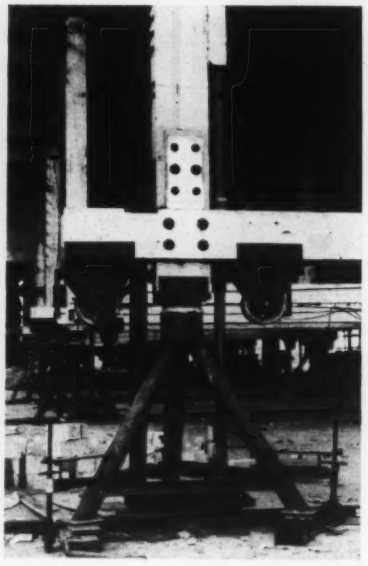


Center-hole jacks are used to tension 16 cables simultaneously to lift section 60 ft wide on each side of center core.



Tie beam across top of wall 30 ft high takes reaction of cables supporting symmetrical roof on each side of central core.





Glued-laminated trusses, columns, and beams with rod diagonals make simple and light traveling form that is lowered by jacks. Care is necessary to prevent racking during moving. Detail shows hydraulic jack, sand jack on tripod, safety column (with pins to control movement in case of hydraulic-pressure failure) and wheels for horizontal movement on rails. Tripods were normally handled by fork-lift truck.

Trans World Airlines Hangar

E. P. LITTLEJOHN
Vice President, Grove, Shepherd, Wilson & Kruge, Inc., New York

Construction, from foundations to completion, of a huge hangar and facilities at the New York International Airport was awarded to Grove Shepherd Wilson & Kruge, Inc., by the Port of New York Authority. The hangar is for the use of Trans World Airlines on a long-term lease.

The work includes: a hangar with a three-story core structure 80 ft wide by 821 ft long with a hangar area on each side, 166 ft by 821 ft, covered by a folded-plate, cable-suspended roof; a two-story-and-mezzanine administration building adjoining the hangar; an underground tank farm for fueling; and a small triturator building.

The unique feature of the job is the construction of the hangar roof. The roof is a reinforced, lightweight concrete slab of a folded-plate design, suspended from cables secured to an anchorage at the top of each of 28 walls across the center core. The typical slab of this construction is 4¾ in. thick. The distance between the top and bottom segments of the corrugations is 5 ft 8 in., and that from center to center of corrugations is 30 ft. The roof hinges at the core, 37 ft above the hangar floor, rises sharply, and then levels out so that the soffit of the front diaphragm is about 46 ft above the floor. The horizontal distance between the rear and front diaphragms is 141 ft. A reinforced canopy 8 ft 9 in. wide extends out from the front diaphragm. Construction joints are at each second repeat of the corrugation—60 ft on centers.

The anchorage assembly, placed across the top of each wall, consists of twenty-four bars 1⅞ in. square and 78 ft long, welded to two 2½-in.-thick anchorage plates (at each end) with machined holes for anchorage pins. The 78-ft-long bars were purchased in one piece to eliminate butt welding.

The overall length and the 60-ft spacing of construction joints favored the use of a traveling form. A two-unit traveler (one on each side of the core) would have to make 14 moves only, but since time was short it was necessary to use two of the two-unit travelers. One started at the north end and

Heavy steel frame permits use of ordinary 200-ton hydraulic jacks to tension roof cables on TWA hangar.

the other at the south end of the hangar, each moving toward the center. The big problem was to find a means of lowering the form about 6 ft for clearance below the roof folds for the horizontal moves. A contract was awarded Timber Structures, Inc., for the design, fabrication, and erection of two two-unit travelers complete. This included single-acting hydraulic jacks for raising and lowering operations, specially constructed sand jacks on a tripod to support concrete loads, and double-flanged wheels for horizontal movement after lowering.

The traveler is of wood construction, using laminated trusses. The deck is ¾-in. plastic-coated plywood to support the 4¾-in. lightweight concrete. There are eight columns, four on a side, with a hydraulic jack mounted on each column. The double-flanged wheels are permanently attached to the base of each column. The structure is braced between columns in both directions by ¾-in. cables with turnbuckles. A wood platform extends the full length of the outboard end to support jacks and men during the jacking operation. The dead weight of each structure is about 100 tons. Horizontal moves are made on four lines of 50-lb rail, resting on used plywood laid over the concrete hangar floor slab.

The complete operating cycle is about 11 working days. Starting with the form in position on the tripod sand jacks, the major steps are as follows:

1. Place reinforcing steel and diaphragm forms—3½ days (about 2 days for each of two units)
2. Place concrete—2 days (1 day for each unit)
3. Cure concrete, place cable and jacks—3 days
4. Tension cables, both units—1 day
5. Lower, move, and raise form—1½ days

The 200 cu yd of lightweight concrete in each unit is placed by crane. When this concrete has obtained a strength of 1,500 psi, the eight suspending cables are pulled through the outboard anchorage blocks and secured. Immediately following this operation, the 200-ton hydraulic jacks are put in position, eight on each side. Pressure is supplied by gasoline-powered hydraulic pumps. As soon as the concrete has obtained a strength 2,500 psi, jacking of the cables can proceed.

Since it is of prime importance that the jacking load be balanced, each crew is kept informed of the pressure-gage reading on each jack by direct telephone hookup. To assist in breaking the initial bond between the forms and the concrete, three mechanical jacks are placed on each side directly under the outside diaphragm walls and the traveler's outboard transverse girder.

The outboard end of the roof is raised about 7¼ in. off the forms. During tensioning, as the cables are elongated, slotted shims are positioned between the shackle flange and the jacking block. During this operation, an instrument party takes readings at 16 predetermined points on each side of the slab to assure even movement.

As soon as the slabs are secured in their final position by the cables, moving of the form is started. The hydraulic jacks are lowered to rest on a chair on each side of the rail used for traveling. The jacks are extended to lift the traveler. The tripod sand jacks are then removed, and the gantry is lowered by releasing the hydraulic jacks, taking extreme care that the traveler does not get out of a level plane by more than 1½ in. Once on the rails, the travelers can be moved into the next position by hand winches or by truck.

When the form reaches its next position, the hydraulic jacks are again seated and pumping starts. Care is taken to raise the form in a level plane to prevent racking. The sand jacks on tripods are again installed under each column as soon as the form has been raised sufficiently. The form is lowered on the sand jacks, final elevation being obtained by bleeding sand through small screw holes in the bottom of the jacks.

The traveler operation has been found to be fast and extremely economical because of the small amount of manpower required. Experience has shown that the single-acting hydraulic jacks will not take lateral loads, and for this reason failures in packing and caps have occurred. This weakness has now been corrected and the job is moving smoothly toward completion.

Engineers for the Port of New York Authority on the TWA hangar are Ammann and Whitney of New York, with Burns and McDonnell of Kansas City, Mo., handling the mechanical and electrical work.

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Busy ferry terminal in Manhattan rebuilt

For fifty years the world's most famous nickel ride, the Staten Island Ferry, began at a stately but outdated terminal in Battery Park, Manhattan, New York. The overcrowded, inconvenient old terminal has been reconstructed to provide a new modern terminal facility substantially completed this year at a cost of $4,000,000.

The primary problems in the new design were to provide adequate waiting room facilities for increased passenger service, to separate the flow of vehicular traffic from that of pedestrians, and to separate the flow of embarking passengers from that of debarking passengers. Further, debarking passengers had to be given ready access to various means of transportation on leaving the terminal. During the construction period, it was mandatory that normal ferry traffic be maintained. Finally, the cost of the proposed construction was governed by a strictly limited budget.

The general layout of the existing 50-year-old buildings, together with the new extension and ramp, is shown in Fig. 1, as well as the location of various transportation facilities.

To approach the problems outlined above, Roberts and Schaefer Company, consultants to New York City's Department of Marine and Aviation for the architectural and engineering design, evaluated the traffic now using the terminal and the future increase reasonably to be expected. A traffic survey was made to determine, first, the maximum passenger concentrations in the waiting room; second, the peak loads to be handled by stairs, ramp and concourses; and third, the patterns of passenger movement to and from the terminal. Results of this survey are given in Fig. 2. Ferry boats, each with a capacity of 2000 pedestrians, leave at 5-minute intervals. In the peak rush, up to 250 outgoing passengers pass through the terminal each minute. The ferries handle 1½ million vehicles a year. The long-range forecast of the future growth of traffic was based on a study of past Department of Marine and Aviation records.

After detailed architectural studies, involving preliminary layouts of alternative schemes, the plan shown in Fig. 1 was adopted. Essentially the old Whitehall Street Building remains and the new extension over South Street provides more waiting-room space and separates passengers from vehicles. In-

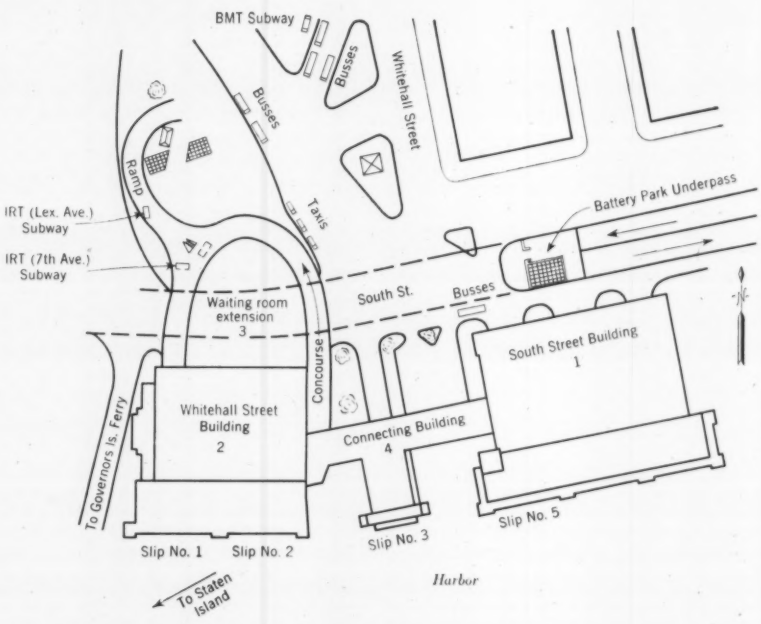
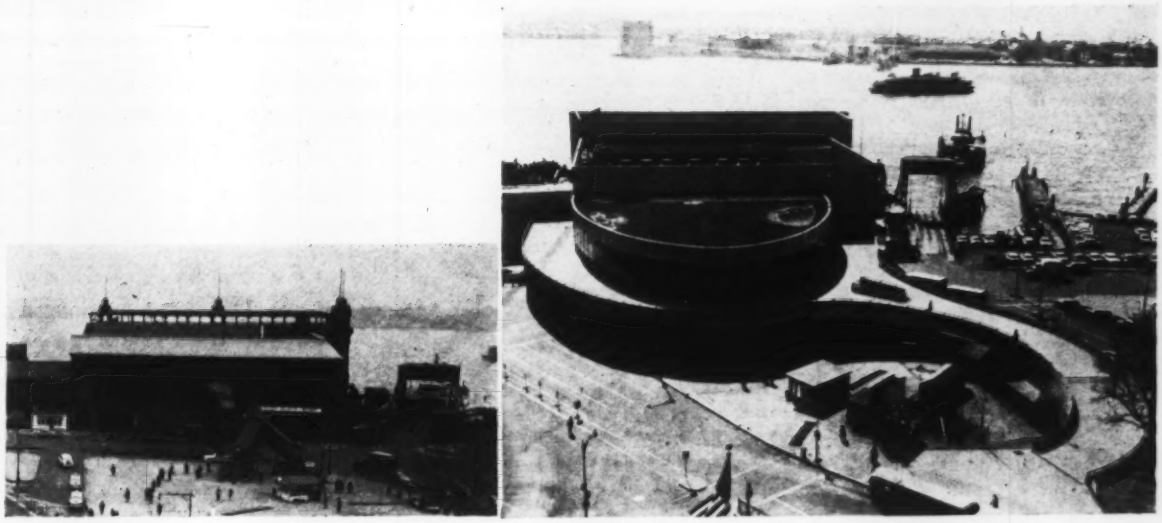


FIG. 1. South Ferry Terminal, before reconstruction, consisted of buildings numbered 1, 2, and 4. New waiting-room and ramp structure, principal feature of this article, is numbered 3.



Fifty-year-old ferry terminal in New York's historic Battery Park is seen before reconstruction at left. It was rebuilt as shown at right. Engineers and contractors faced design and construction problems peculiar to a city with a maze of underground structures. Completed four-million-dollar facility handles peak of 250 passengers per minute. Ventilation tower of Brooklyn-Battery Tunnel appears in distance, at end of Governor's Island. Beyond is Staten Island, objective of ferries serving this modern terminal.

coming passengers reach the waiting-room on the second-floor level by moving stairs from a street-level vestibule. Passengers debark from the ferries at the upper deck level, leave the terminal by the outer concourses, and descend by stairs or ramp to the street level. All pedestrian traffic is routed through the second-floor level and thus is separated from the vehicular traffic which enters the terminal at street level and is loaded on the lower decks of the ferry boats. This layout effectively prevents intermingling of traffic and provides passengers with access to their ultimate destinations according to the distribution indicated by the survey.

To provide for continuous ferry service during construction of the new facilities, a part of the South Street Building was renovated for use as a temporary terminal during the period that the Whitehall Street Building was shut down. Maintenance of normal ferry service required that at least two of the four ferry slips be kept in use.

After consideration of all the factors involved, it was found that the work proposed could be done within the budget only by using as much of the old Whitehall Street Building as possible, by omitting roofs over concourses and ramps, and by postponing complete rehabilitation of the South Street Building to a later date. However the budget did provide for the modernization of the third and fourth floors of the South Street Building for use by the Department of Marine and Aviation as administrative offices.

As the job progressed, additional sums became available for modernization of the movable traffic bridges between the terminal and the ferry boats. The old street-level vehicular bridges will be replaced and the upper-level pedestrian bridges will be widened consistent with the diversion of passenger traffic to the second-floor level.

Once the basic plan was set, a construction schedule was worked out as follows:

1. Repairing and painting of the South Street Building for temporary use
2. Rehabilitation of the Whitehall Street Building
3. Construction of a new waiting-room extension, concourse, and ramps
4. Rehabilitation of the connecting building

Partly because of the schedule and partly because of city requirements, the work was divided up into a number of separate general contracts. This meant that Roberts and Schaefer Company had the responsibility for coordinating the work of 13 different general contractors on this project. Although the whole project is covered here, the construction of the new waiting-room extension is featured. This presented the principal engineering challenge.

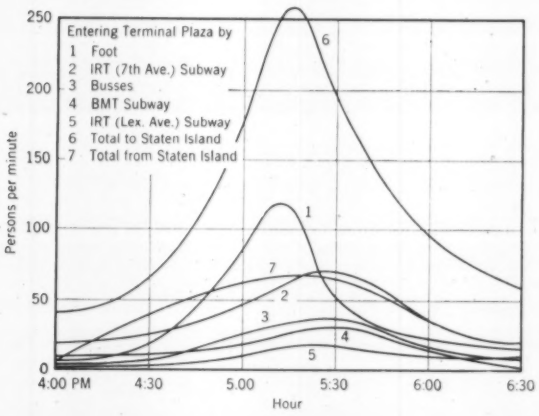


FIG. 2. Pedestrian traffic patterns are plotted for evening peak.

Design and construction of extension

Immediately after completion of the contract to provide temporary waiting-room facilities in the South Street

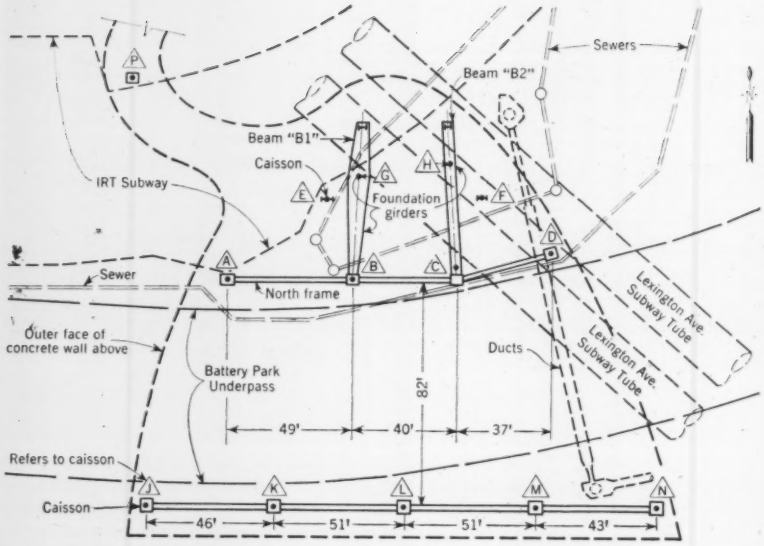


FIG. 3. Subsurface locations of foundation girders and tie beams for reinforced concrete frames are shown, as well as major underground structures.

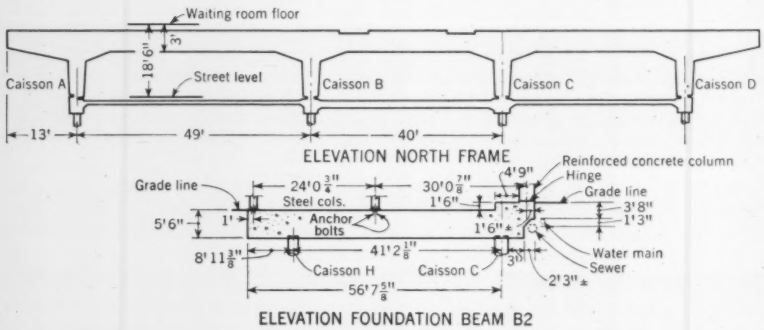
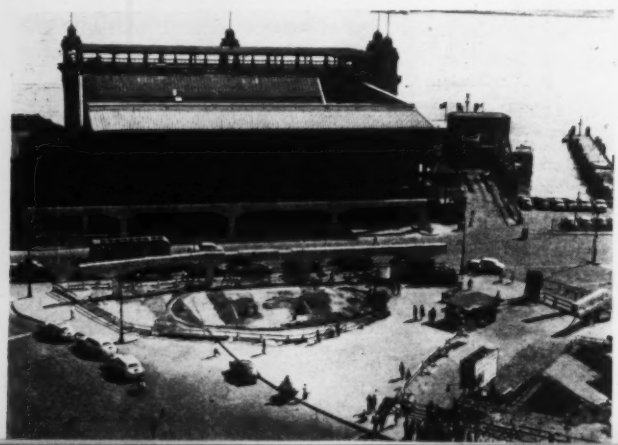


FIG. 5. Elevation shows reinforced concrete frames and subsurface foundation girders locations of which are indicated in Fig. 3. These are supported entirely on Drilled-in caissons extending to rock.

Main concrete frames for waiting-room extension are seen in place each side of South Street. Note concrete T-frame at right, only intermediate support for curved ramp 160 ft long.



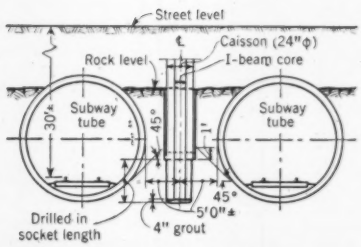


FIG. 4. Three of 14 Drilled-in caissons were centered between twin tubes of Lexington Avenue Subway and extended 15 ft into rock to bearing below bottom of tubes.

Building, Slips 1 and 2 at the Whitehall Street Building were closed down and construction of the new waiting-room extension was started.

A plan of the extension showing the general layout is given in Fig. 1, and the subsurface obstacles over which this new structure had to be built, in Fig. 3. The main waiting-room and most of the concourse areas extend over South Street where no supports could be placed because of the 80-ft-wide Battery Park Underpass located directly under South Street. Also the north end of the extension, with the street-level vestibule, is located partially over the twin subway tubes, and the curved pedestrian ramp spans the wide underground track and station facilities of the IRT subway. Foundation design and construction constituted the major problem.

Complicated foundations

Because of the severely restricted area in which foundations had to be located, it was possible to extend supports down to rock in only a few isolated places. Drilled-in caissons were chosen since loads as high as 1,300 kips could be carried by a unit only 30 in. in diameter. These caissons, however, could not economically resist bending moments and horizontal thrusts. For this reason the main concrete frames of the superstructure were hinged at the base of their columns to eliminate moments, and tie beams were provided between hinges to remove thrusts from these relatively long, slender caissons. In this way, only vertical loads are carried by the caissons, permitting their size to be a minimum.

The Drilled-in caissons consist of open-ended steel shells 24 or 30 in. in diameter, filled with high-strength concrete of 4,000 psi, and where required they were reinforced by a steel H-beam core.

The most critical foundation problem came with the caissons between the Lexington Avenue Subway tubes. As seen in Fig. 4, these 24-in. caissons were drilled far enough into rock so that no load would be transferred to the tubes. Since the tubes are just 10 ft apart, there was no room for error. During driving, men and instruments were set up in the tubes and above ground to detect the slightest movement or danger to the tubes. When it is remembered that these tubes are 30 ft below the street level and that ground-water level is only 5 to 10 ft below the surface, the danger resulting from a damaged tube can be easily visualized. It is understandable that officials of the Transit Authority insisted that every precaution be taken to avoid any damage to the tubes.

In addition to the known underground obstructions, the contractor drove the 14 caissons through miscellaneous remnants of old construction work consisting of layers of old blacktop, concrete and cobble pavements, trolley-car tracks, an old boiler, a brick vault, and a maze of unmapped pipes.

In certain locations at the north end of the extension, it was not feasible to carry all the superstructure columns directly on caissons without rearranging the columns and substantially increasing the cost of the superstructure. Instead, two large underground reinforced concrete foundation girders, shown in Figs. 3 and 5, were built to carry column loads to the caisson locations.

Unsymmetrical superstructure

Most of the superstructure is supported by the two reinforced concrete frames, one north and one south of Battery Park Underpass. The columns of the frames are unevenly spaced because of subsurface obstructions. The location of the subsurface members of the frames is shown in Fig. 3, and an elevation of the north frame and one of the foundation girders can be seen in Fig. 5. In the north frame, one bay had to be skewed 14 deg, and exterior columns resting on this frame had to be set back from the building line. This required relatively long cantilever end spans. The dimensions of the frames were practically fixed by surrounding conditions.

The new waiting-room floor had to be flush with the existing second floor of the Whitehall Street Building, thus fixing the top elevation of the frames, and truck clearance fixed the soffit elevation of the south frame. The road elevation could not be changed because of the necessity of matching the level of the existing slips. Because of these restrictions, the frames had to be designed as stiff, haunched members.

Aside from making the foundation design feasible, concrete hinges at the column bases had the further advantage of substantially reducing moments and thrusts in the frames due to temperature and shrinkage. The high thrust on the exterior columns required an inclined hinge so designed that the resultant force would be closely perpendicular to its face. Apart from the two frames and the second-floor slab, the superstructure consists of structural steel.

The long span of 90 ft over South Street presented a difficult framing problem. For economy, only standard rolled steel sections were used, and their use was made possible by having them act with the concrete floor. Composite action was assured by welding spiral shear connectors to the top flanges of the beams. To provide for the high load concentrations, plates were added to the bottom flanges of the rolled sections and some compression reinforcing was placed in the concrete floor over the top flange.

To avoid splicing, all the rolled sections were shipped to the site directly from the rolling mill by rail and barge. Cover plates, stiffeners, and all connections were field welded. Since most of the connections were skewed, it was found much more economical to make the connections in the field than to detail them on paper for shop fabrication. After all the beams were erected, the spiral reinforcing was welded to the top flanges.

Steel columns were erected on the concrete frames, and plate girders were placed over the columns to support the roof. These girders were designed for dead load, with cantilevers at each end. Later, the free ends were framed to steel pipe columns which provided live-load support for the girders. Continuous roof beams spanning over the plate girders were designed as cantilevers for dead load and later were also supported by the pipe columns. In some cases, these continuous beams induced large uplifts on the pipe columns, and the floor beams below had to resist these forces. A metal deck completed the roof structure. To control the location of all the irregularly placed non-parallel beams, a coordinate system was devised for all structural members.

With all the structural steel erected, a new contract was let for completion of the extension and rehabilitation of the Whitehall Street Building. The contractor's first operation was to cast the concrete on the concourse and waiting-room floors and the parapet wall around the concourse. This parapet serves both as a wall and as a structural beam, carrying part of the slab load around the periphery of the extension.

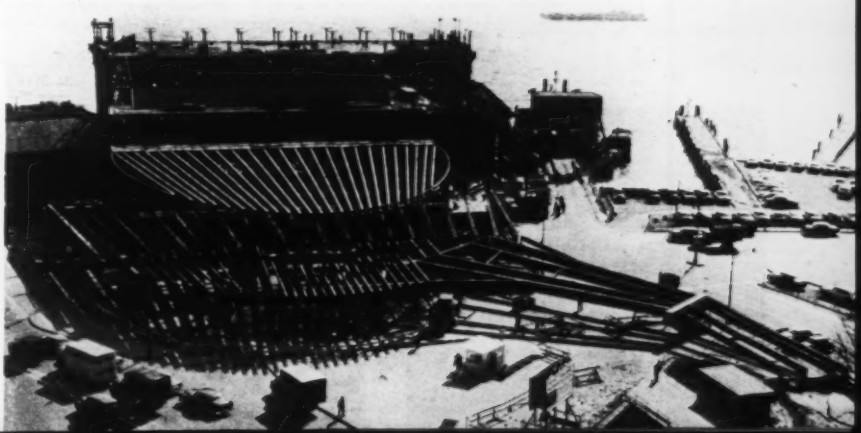
Particularly important was the construction of the curved walls, which are essential to the architectural concept. On the street level, a glass-enclosed lobby area was built, consisting of curved concrete grade beams supporting closely spaced pipe columns, which in turn provide the framing for the plate-glass wall panels.

The problem of the walls extending from the waiting-room level to the roof was much more serious. Since the glass wall panels are supported on a floor which deflects considerably, it was necessary to set the elevation of each panel carefully. The bottom elevation was based on the total deflection of the waiting-room floor and the top was dependent on the deflection of the roof.

Curved pedestrian ramp

A special problem was posed by the curved ramp, designed to permit easy pedestrian flow from ship to shore during rush hours. The general shape

Unsymmetrical pattern of structural steel for waiting-room floor and roof, concourses and ramp, was fabricated and welded at site for economy.



of the ramp was fixed by space limitations. Pedestrians must descend nearly 20 ft on a slope of about 10 percent. Since a straight ramp would have ended in the middle of the street, a curve was used made up of a combination of arcs of different radii, adding a striking architectural feature to the project.

Structurally, the smooth curve presented difficulties. The wide IRT subway station and tracks pass directly under the construction, so that only a single column support could be fitted into the honeycombed subsurface area. A length of over 160 ft of curved ramp is supported by a single caisson. The concrete ramp slab is tied to the steel beams by welded spiral shear connectors to provide composite action. The complex shape of the ramp required a system of coordinates in three dimensions to locate each member.

Since both the concourse around the waiting-room and the curved ramp are uncovered, it was necessary to provide an all-weather surface. Snow-melting coils of wrought-iron pipe were installed in a lightweight concrete fill over the structural slabs which, together with a broom-finished wearing surface, provide a safe surface in all types of weather.

The job of rehabilitating the Whitehall Street Building was carried forward at the same time as the work on the new extension. The structural frame of this old building rests on thick concrete caps supported on wooden piles which were almost continuously under water. These piles were found to be in excellent condition, but the bases of many of the structural steel columns were badly corroded and had to be repaired. The rest of the structure was found to be in good condition, needing only a thorough cleaning and painting to give service for another fifty years. Since this framing, designed in 1904, used allowable stresses considerably below those considered good practice today, additional loads as well as redistributed loads could be taken without overstress. Thus new stairs, a terrazzo finish in the waiting room, and new suspended ceilings, could be incorporated in the building to blend with the architectural treatment used in the new extension.

The facade of the old building presented a problem. It was important to use a material that would combine light weight with long life, and ease of maintenance with attractive appearance. Porcelain-enameled panels, although previously used only on relatively small installations in the New York area, were selected as most nearly meeting the requirements. New girts to carry these panels were welded to the existing framing.

Unlike the piles supporting the concrete caps, a large proportion of the wood piling supporting the street-level floor, which has been alternately exposed to water and air for years, was found to be rotted and in need of replacement. Dock workers, a trade peculiar to New York and other maritime areas, worked below the deck while other construction proceeded overhead. Piles in need of repair were spliced with new treated timbers without disturbing the first-floor slab in any way.

During the summer construction season, the existing heating plant was replaced with new Scotch Marine boilers to provide heat for both the South Street and the Whitehall Street Buildings, as well as for the new waiting-room extension. The space between the waiting-room or second-floor beams of the extension was used as a plenum for heated air, which provides radiant heating of the floor, primarily to keep it dry.

Plumbing, which originally discharged directly into the river, was completely renovated. Since the top of the Battery Park Underpass is within a foot or two of the street level, there was no room for sewer lines. Two large sewage ejectors were installed to pump the waste up over South Street and thence down to existing sanitary sewers. Again the plenum between the beams was utilized for the piping.

Slips 1 and 2, together with the new extension and ramp, were opened to traffic in July 1956. The same afternoon Slip 3 was closed down and demolition started preparatory to the rehabilitation of the connecting building, marked "4" in Fig. 1. For this building, rehabilitation processes similar to those followed in remodeling the Whitehall Street Building were used, notably application of porcelain-enameled panels over the existing steel framing together with new roof framing, decking and roofing. Concurrent with the work on Slip 3, remodeling of the third and fourth floors of the South Street Building was begun to provide office space for the Commissioner and his Department of Marine and Aviation. New elevators have been installed also, but this new construction is faced with corrugated metal in keeping with the plan to postpone total rehabilitation of this building.

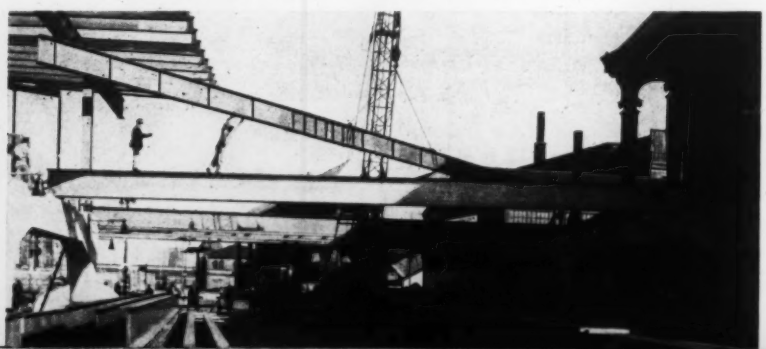
On completion of this terminal, the City of New York will have a modern operating facility comparable with its counterpart at the Staten Island end of the ferry run. Utilization of most of the existing structures together with other economies kept the project within the stipulated budget, with a minimum of inconvenience to the traveling public.

Design of the terminal was under the direction of the Department of Marine and Aviation of the City of New York, Vincent A. G. O'Connor, Commissioner. Captain Lewis H. Rabbage is Chief Engineer and Captain Emil A. Verpillot, M. ASCE, Deputy Chief Engineer. John M. Buckley, A.M. ASCE, was consulting engineer to the Department of Marine and Aviation. The co-authors of this article served under the direction of Dominic P. Denitto, Vice President of Roberts and Schaefer Co.

(This article is based on the paper by the authors to be presented at the ASCE Annual Convention, before a Construction Division session presided over by Walter L. Couse, a member of the Division's Executive Committee.)

Heating coils to melt snow are embedded in top coat on exposed concourses and ramp.

Some of longest beams span 90-ft. distance over South Street.



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Prestressed piles and deck for highway-railroad causeway

With more than 13,000 cu yd of prestressed concrete in piles, stringers and railroad-deck slabs, the 6-million-dollar Pelican Island Causeway will be the largest major structure on the Texas Gulf Coast employing this type of design. Scheduled for completion in October 1957, this 1½-mile-long facility will provide a direct highway-rail crossing of the Galveston Ship Channel between Galveston and Pelican Island. This is the first step in an overall program for the industrial, commercial and residential development of Pelican Island.

Starting at grade on 51st Street, just south of the railroad switching yards in Galveston, the new structure rises on a ramp to a prestressed concrete two-lane highway viaduct 1,815 ft long, crossing the railroad yards. From the north side of the yards, where the causeway railroad track begins, the structure consists of some 2,700 ft of slope-protected hydraulic embankment, confined within precast concrete sheetpiling. This embankment continues for a distance of some 900 ft offshore.

From the end of this embankment to Pelican Island, several different types of construction are incorporated in the causeway. First comes 1,000 ft of prestressed concrete trestle supported on pile bents. (See Fig. 1.) Next, four 102-ft steel-girder highway-railroad spans on concrete piers flank the south side of the 160-ft single-leaf bascule bridge, and five similar 102-ft steel-girder spans flank the north side of this movable span. Then come 1,100 ft of prestressed concrete trestle spans, and finally 400 ft of hydraulic embankment terminating on Pelican Island.

A most interesting feature of the structure is the unique combination of a 50-ft-span highway and a 25-ft-span railway bridge on the concrete approaches to the center steel section. The pile caps at the bents that are common to both the highway and the railroad superstructures have vertical joints designed to permit any unequal settlement without overstress and yet to restrain longitudinal and lateral movements.

Five piles are used in each simple bent for support of the highway, and three piles for support of the railroad. At the fixed supports, four battered and three vertical piles are used under the highway and four battered piles under the railroad. Battered piles have a slope of 6 on 1. For the simple bent, the outside pile at each end is battered in the line of the bent to resist transverse forces. At the fixed bent, the two outside piles at each end are battered diagonally against forces in any direction. Two interior piles under the highway and two under the railroad are battered longitudinally. Between these bents, on 50-ft centers, an additional group of three piles, two of them battered transversely, supports the railroad only, to reduce its span to 25 ft.

Piles used are 24 in. square. In the center of each pile there is a Sonovoid tube (of heavy paper) with an out-

Pelican Island Causeway nears completion at Galveston, Tex. It will open up the 4,000-acre island to industrial and commercial development.

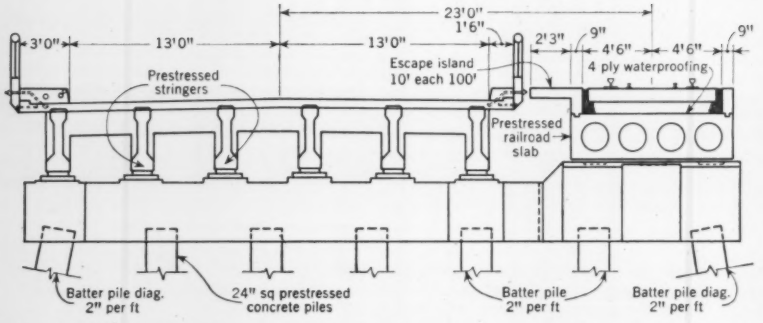


FIG. 1. Cross section shows causeway construction at a fixed bent. Pile cap is cast in place, then prestressed stringers are set and deck forms are placed. Later prestressed deck slabs 25 ft long are placed for railroad support.

Diversity of causeway construction is shown by concrete trestles, steel spans, and fill retained by concrete sheetpiling. Rigs at lower left set piles 24 in. square in positioning frame and drive them to predetermined depth. Note pattern of concrete-pile bents.

side diameter of 10 in. Thirty ⅜-in. wire strands are equally spaced on four sides. Piles vary in length from 50 to 94 ft, and each is driven to carry a total applied load of 65 tons.

The structure is designed in accordance with 1953 AASHO and AREA specifications. Live load on the highway portion is H-20-S16-44, and that for the railroad is equal to General Motors' diesel locomotive type NW-2-1000, which is 44 ft 6 in. long with two trucks on 22-ft 0-in. centers. Each truck has two axle loads of 62 kips spaced 8 ft apart. This is followed and preceded by a number of loaded cars of similar dimensions carrying axle loads of 50 kips each. Maximum impact for the railroad live load is 25 percent.

Each 50-ft highway trestle span has six precast prestressed concrete stringers spaced 5 ft 2 in. on centers, designed as T-beams acting with the 6½-in. cast-in-place deck slab. Concrete diaphragms are provided at ends and third points of each span. In section, stringers are 3 ft 7½ in. deep, approximately I-shaped, having twenty-eight ⅜-in. strands of high tensile strength in the bottom flange and eight similar strands in the stem, each pretensioned to 12 kips. The 25-ft railroad spans consist of precast prestressed concrete slabs 10 ft 6 in. wide and 2 ft 8 in. deep, with four Sonovoid tubes of 20-in. outside diameter on 2-ft 6-in. centers, located 16 in. above the bottom and 18 in. from each side. Five wire strands of ⅜-in. diameter are located near the top of the slab, five near the center, and 64 near the bottom of the slab.

The prestressed parts of the structure required the manufacture and driving of 660 piles, and the manufacture and erection of 420 highway stringers and 84 railroad slabs. A casting yard was set up at Pasadena, Tex., some 35 miles from the job, and the members were barged to the site as required. Casting beds permitted placing of concrete for 400 lin ft of pile per day, with an equivalent production cycle for the girders and railroad slabs.

Specifications set up for the work called for seven sacks of cement per cu yd for 5,000-lb concrete containing a retarding-densifier admix. Each wire strand was to be stressed to 12,000 lb and cut when the concrete developed a compressive strength of 4,200 psi. To increase production, the contractor elected to use steam curing, and by controlling the steam temperature between 150 and 155 deg F he secured a concrete strength of 4,200 psi within 18 hours.

Briefly, the manufacturing proce-

dure for the piles was as follows:

1. Strands were threaded for the full length of the bed, anchored, and stressed sufficiently (± 400 lb per strand) to hold them taut.

2. Open paper tubes were positioned and the strands stressed to the full load of 12,000 lb per strand.

3. Bulkheads were inserted, and the paper tubes tied down. Extreme care had to be exercised in the latter operation since the open tubes are susceptible to floating.

4. Forms were erected and concrete was placed. Steam was applied directly after proper finishing of concrete.

5. After approximately 14 hours of steam curing, the forms were removed section by section while the application of steam continued.

6. Steam was reduced gradually for about an hour; stress was released, and strands cut after the concrete had obtained the required strength of 4,200 psi.

The principal problems encountered during the manufacturing process were in connection with the steam curing. Steam temperatures, time when steam curing is begun, and length of curing period are all critical items. Deviations from the rigid norm established for the curing period invariably led to erratic test results, and in some cases to unsatisfactory members. The advantages of steam curing are, however, evident; they consist principally of increased volume of production and reduced manufacturing time.

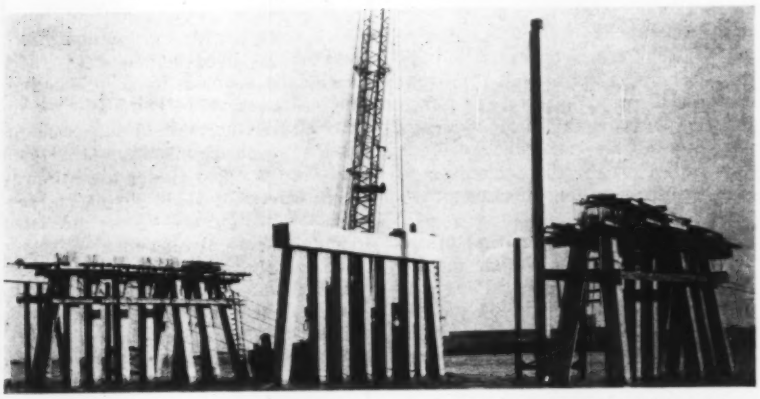
Besides producing a more dense concrete, use of a retarding densifier afforded some control of setting time. During the casting of the prestressed members it was found that any delay in starting the steam curing resulted in a marked loss of early compressive strength. When concrete was placed in forms 400 ft long, it was necessary to control the set so that curing could be started when the concrete had reached the proper stage. The ability of the admix to control set was found helpful in providing a margin of working time for placing concrete, finishing, and covering. The densifier employed, Plastiment, was a non-hydroscopic powder free from calcium chloride and foaming or air-entraining agents. It was used in the proportion of ½ lb per sack of cement at placing temperatures below 64 deg F, ¾ lb per sack at temperatures between 66 and 84 deg F, and 1 lb per sack at 85 deg F and above.

During construction, several facts were noted in regard to the handling of the prestressed members. The prestressed piles proved to be tough, durable and almost indestructible. Men working with these piles praised them highly because of the ease with which they could be handled in contrast to ordinary reinforced concrete piles, which are relatively fragile. The prestressed concrete stringers and railroad slabs were equally durable and especially rigid. These factors, among others, were reflected in greater ease and rapidity of erection, and made the prestressed design features of the causeway especially successful.

Speed of erection and rigidity featured erection of stringers. A 50-ft section of roadway composed of six stringers could be erected completely in about two hours. By inaugurating a procedure of sequence flow, the contractor for the trestle work was able to place concrete in a deck slab every other day. The slabs were finished with the aid of a 50-ft vibrating longitudinal aluminum screed.

The water-crossing substructures, the causeway, and the hydraulic embankment sections are being constructed by Farnsworth & Chambers Co., Inc., of Houston, Tex. Superstructure steel, including the bascule span, is being handled by the Kansas City Bridge Co., Inc., of Kansas City, Mo. The viaduct crossing of the railroad yards is being built by Texas Gulf Construction Co., Inc., of Galveston, Tex.

Sponsorship of the Pelican Island Causeway by the Galveston County Navigation District No. 1 is being administered directly by its Commissioners, with the Hon. Charles G. Dibrell, Chairman. Parsons, Brinckerhoff, Hall & Macdonald of New York and Houston, Tex., are the consulting engineers for the design and supervision of construction of the facility, with Maurice N. Quade, M. ASCE, partner in charge, and A. M. Alpert, A.M. ASCE, resident engineer.



Bents of 24-in. precast prestressed piles support highway deck at 50-ft centers. Added support at mid-span reduces span length of precast rail deck to 25 ft. Note driving template set for installation of three-pile mid-span bent for rail deck.

Big 24-in. piles are cast in bed 400 ft long. Thirty ⅜-in. wires are stressed to 12,000 lb each around Sonovoid tube of 10-in. outside diameter. Frames hold open paper tube down while concrete is placed.

The Engineer through the Ages

The Architectus of the Roman Empire—Part 1

J. K. FINCH, M. ASCE, Dean Emeritus and Renwick Professor of Civil Engineering, Columbia University, New York, N. Y.

Two justly famous engineering books of the second major period of Roman history, the Empire, have been preserved. The first of these, the treatise of Vitruvius covering the entire field of activity of the master builder of his day, dates from the reign of Augustus (31 B.C. to 14 A.D.), the heir of Caesar and the first emperor who ruled during what has been called the Golden Age of Rome. The second of these books, by Frontinus, covers the history, maintenance and operation of Rome's water supplies. This remarkable report dates from a century later, the beginning of the Age of the Five Good Emperors which marked the last great period of the Empire.

Both of these books give us an insight into the scope and character of the work of the Roman engineer. The contrasting status of the two authors reveals the fact that the credit for Rome's engineering achievements must be shared between the top-ranking official, represented by Frontinus, and the simple *architectus*, represented by Vitruvius.

Vitruvius lacked the "classical education" enjoyed by those of high rank. Although he embellishes his story with various references to historical and literary sources in an obvious effort to impress his readers with his learning, he admitted that he writes "not as a very great philosopher, nor as an eloquent rhetorician, nor as a grammarian, but as a master builder, who has only had a dip into these studies." He gives us an interesting picture of materials, machines and construction planning but is exasperatingly indefinite in a number of cases.

Frontinus, on the other hand, probably came from a noble family, had served as military governor and general in Britain, and, after his tour of duty as *Curator Aquarum*, or Commissioner of Water Supply for Rome, had a brilliant career in the war against the Dacians and was twice consul. The reader of his report is impressed by his sincerity and honesty and his abilities as an administrator. In spite of his high rank, it is evident that Frontinus had a clear understanding of engineering problems. In this respect he may have been somewhat exceptional for, as he says, he scorned the complacency and lack of fitness for office of the man who performs "the duties of an office entrusted to him according to the direction of assistants."

A number of the letters that passed between the Emperor Trajan and his governor in Asia Minor, Pliny the Younger, also throw light on the engineering knowledge of Roman administrators. These letters reveal sound engineering understanding as well as the interest of Roman leaders in public works and economic development.

Under these conditions we would expect to find Roman engineering activities varying greatly in scope and volume with changes in political control. But pressing economic and public needs could not be denied. Even such weak or puppet emperors as Claudius undertook notable works, though inspired perhaps by the desire for public approval rather than by a deep sense of public service.

Vitruvius' "De Architectura"

Supposedly written about 15 B.C., the *De Architectura* of Vitruvius consists of ten books, or as we would call them today, ten chapters. Several editions appeared among the first published books, the incunabula—that is, books printed before 1500 A.D.—and it became the standard reference work of the architects of the Renaissance. The many modern editions are distinguished particularly by attempts to supply the lack of the original drawings, which were lost in antiquity.

Little is known of the author, Marcus Vitruvius Pollio. He has been described as an obscure and relatively unimportant master builder who never would have been known to us had his books not survived. Clearly he was far from satisfied with the trends in building, the standards of construction, and the status of the *architectus* in his day. He was worried because "this great art" was "so boldly professed by the uneducated and the unskillful."

That he lived in unsettled times cannot be doubted. Rome was becoming cosmopolitan in character. The influx of newcomers from the provinces and of discharged soldiers, the tendency of the upper classes to turn away from careers of public service to business or idle luxury—these and other factors were creating new economic problems and unrest. The Roman poet Horace notes with feeling the luxury and lack of responsibility of his age as contrasted with the simple, sturdy, toiling life of earlier days. Construction methods were also undergoing change. The old solid stone masonry was giving way to cheaper brick and concrete. Also, there may have been a personal reason for Vitruvius' criticisms if his own career was not turning out to be too successful. It is unfortunate that he could not have foreseen the immortality his treatise was to bring him.

The first chapter of this work deals with the education of the *architectus* and building in general. As Straub notes, the list of subjects the *architectus* should know—from astronomy through history, law, music, and medicine to philosophy—"tends to arouse a suspicion that this model architect is a product of Vitruvius' imagination rather than a reflection of Roman reality." Yet, as the old Roman notes, the combination of services the *architectus* was called upon to provide involved at least a smattering of knowledge in many fields—astronomy in surveying and in making sun dials, history in the proper use of architectural ornament, law in contracts, and medicine in the laying out of cities and the provision

Initial: Pont du Gard in south of France is one of most imposing structures of ancient times. It dates from reign of Rome's first emperor, Augustus.

of pure water. He also advises some understanding of music for the tuning of such military equipment as catapults. Philosophy of course included the mathematics and science of the day.

Vitruvius discusses leveling instruments and the work of the *librator*, or leveler, but has nothing to say on land surveying. He favors a device he calls the *chorabates*, a plummet type of level plus a water trough, rather than the *dioptra* level described by Nero. There was a well-developed Roman system of land division in rectangular plots, many of which can still be seen, and are reminiscent of our own public-land survey system. The *groma*, or right-angle sighting device, which survived in later times as the "surveyor's cross," plus a wood measuring rod, the *decempeda* of 10 Roman feet, used by the Roman "chainman" or *decempedator*, were the standard equipment of the land surveyor, the *agrimensor*, in that age of right-angle surveying.

Chapters 2 to 7 of his treatise are devoted to building construction but also describe materials. His attribution of the various qualities of timber and stone to their supposed affinity for the elements of fire, water, etc., recalls an unscientific age, but his observation that sand for mortar and concrete "shall be sharp and free from dirt" has survived in the specifications of the present day.

Chapter 8, on water supply, discusses sources with shrewd observations on the cycle of evaporation, rainfall and runoff, as well as on quality and on the dangers of poisoning from lead, the standard material used for Roman pressure pipes. The leveling and construction of aqueducts and the design of sand traps, fountains, and distributing tanks are also described.

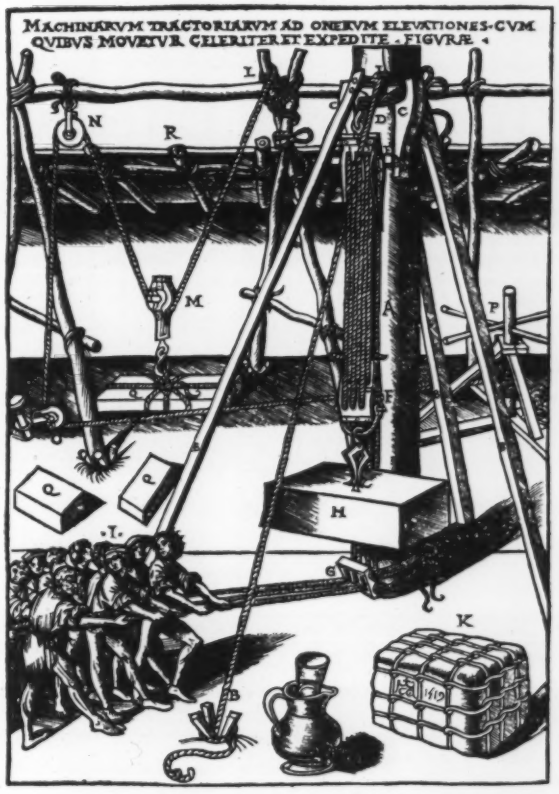
Chapter 9 is devoted to a problem that long has ceased to be of interest to engineers—the measurement of time by sun dials and water clocks. One may speculate, however, that the lack of simple and accurate time pieces was a factor in the long lag in the development of dynamics. The Roman measured the flow of water, for example, solely by the cross-sectional area of the pipe or conduit, and seems to have had no conception of such a factor as velocity. In fact, as Herschel remarks in his translation of Frontinus, it took over a thousand years of later experience and experiment before $v = \sqrt{2\,g\,h}$ could be written on the blackboards of our schools.

In the last book, Chapter 10, we find a description of the machines used by the Roman *architectus*. These include hoisting gear, derricks, pulleys and pumps, as well as the water organ of the Greek Ctesebius, and the contemporary engines of war, catapults, balistae, etc. Of mechanics, even the simpler statics, there is hardly a hint. Vitruvius argues strongly that theory should be tempered with practice. "Those who rely only on theories are obviously hunting the shadow, not the substance," he remarks. What he refers to as theory appears to have been limited to the statement of a few rules-of-thumb in numerical terms.

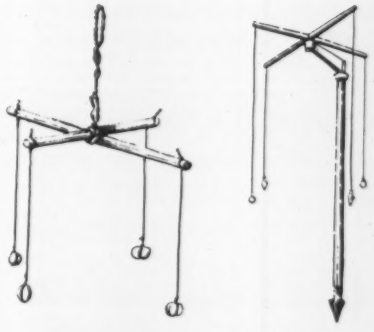
The viewpoint of this sturdy old Roman is perhaps best summarized in his own words, the earliest surviving suggestion for a code of ethics relating to professional practice, "Let the *architectus* not be grasping nor have his mind preoccupied with the idea of receiving perquisites, but let him with dignity keep up his position by cherishing a good reputation. No work can be rightly done without honesty and incorruptibility."

Among the eighty editions of his masterpiece, the translation by Morgan is probably best known, but many illustrations of interest are to be found in the other editions.

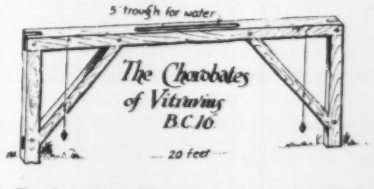
(Subsequent articles will continue the story of engineering construction under the Caesars.)



Roman hoisting equipment, including pulleys, capstans, treadmill hoists, and even pile drivers — all operated solely by manpower — remained standard construction equipment until advent of steam machines in nineteenth century. Original drawings for DE ARCHITECTURA, Vitruvius' famous treatise of about 15 B.C., have been lost, and various attempts to reconstruct them have appeared in the 80 editions since issued. This woodcut is from one of the earliest editions of his masterpiece.



GROMA was favorite instrument of Roman GROMATICI for laying out directions at right angles. This simple device could be either held in the hand or supported by an arm offset from a staff. After Stoley and Della Corte.



For leveling, Vitruvius favors the CHORABATES, a plummet type of level equipped with a water trough.

Mexico City's Earthquake Damage

Both authors of this article have had wide and continuous experience for the past ten years in the design and construction of foundations in and near the City of Mexico. They drove the first long cast-in-place concrete piles to be used in that city. These piles support the new 43-story Latino Americana Tower, which came undamaged through the earthquake of July 28, 1957. Earlier, for the Mexican Government, they devised a comprehensive plan, in association with Spencer, White & Prentis Inc., for underpinning the Palace of Fine Arts should future settlement require it. (See article by them and by C. B. Spencer, in *Civil Engineering*, June 1955, page 50.) They have examined a number of buildings in the area of maximum shock and here report the facts as they observed them. In a future issue they will offer their personal views on the lessons to be learned from the catastrophe.

The writers spent a crowded four weeks in examining the wrecked buildings left by the severe (Mercalli 7) earthquake which struck Mexico City in the early hours of July 28, 1957. The buildings described in this article include all those over six stories in height, in the area where the greatest damage occurred, on which the writers have been able to date to obtain basic data. A few lower buildings of special significance are included.

The opinions here expressed are the writers' own deductions based on personal observation and background of knowledge. Mexico City authorities showed them the utmost courtesy and assisted them, along with other interested engineers, in every way possible. But the writers were given no information, facts, or opinions not available to the public.

The following remarks are confined to the question, "What are the facts about this quake and the deductions from them that may point the way toward more nearly shock-proof design?"

The losses caused directly or indirectly by this earthquake are severe indeed but there is one important gain to be entered on the credit side. Never before have engineers had such an opportunity to study earthquake effects on a large group of modern buildings in close proximity to one another but varying widely in type as regards both foundation and superstructure. Books, articles, and committee reports full of brilliantly argued theory have been prepared in abundance, but painfully little comparative factual evidence can be found. There have been few opportunities to study results and compare them with those the designer anticipated under the theory on which he based his earthquake resistant design. It is believed that an analysis and application of the facts made available as a result of this earthquake will point the way to a practical and economical solution to the problem of designing and constructing buildings to resist any reasonably probable future earthquake in Mexico City.

While the July seismic disturbance was felt over most of the southern half of Mexico, there is what might be called a "laboratory area" of almost 2,500 acres in the heart of Mexico City where the wreckage was most severe. Many core borings taken under the writers' direction in this area, and the evidence of thousands of piles driven here, reveal a soil profile of unusual uniformity. There are supposed to be a number of islands of firm material within the original Lake of Mexico but we have observed none in the area of severe damage. One would look long to find equal uniformity of soil conditions in any major city in the United States.

Within this "laboratory area" the buildings range in structural type all the way from old brick and stone on light wood piles, or on complete or incomplete rafts, to a 43-story ultramodern skyscraper on concrete piles of Button-Bottom type driven to point bearing on a thick stratum of cemented sand at a depth of 110 ft below the curb. This skyscraper, the tallest building in the Americas south of the United States border, came through without a crack or a single broken pane of glass.

A large part of Mexico City is virtually floating on a deep underground mud lake. The soil is volcanic bentonite clay with a water content that sometimes reaches the surprising ratio of 5 parts of water to 1 part of solids by weight. Thin layers of sand are interspersed through the clay but the stratum to which bearing piles carry their loads is a cemented volcanic sand deposit varying from 10 to 30 ft thick in different parts of the city.

In a relatively short time, Mexico City has grown tremendously in population and now has over 4,000,000 inhabitants. This growth has posed an all but insuperable problem as regards the domestic water supply. As a temporary solution, several thousand wells have been drilled within the city limits, and pumping from these wells has caused a city-wide subsidence. The sewage disposal scheme, which looked so effective in prospect, has produced a partial desert outside the city and has increased the subsidence considerably by draining away the water that previously remained in the original lake bottom. These factors are responsible for the settlement of streets, sidewalks, and such buildings as are not on pile foundations.

Differential settlement takes place between the surface of the ground and the 110-ft-deep sand layer on which the piles of some foundations bear. Although it is commonly stated that the City of Mexico settles at the rate of 1 ft a year, actually the *differential* settlement between the surface of the ground and the sand layer on which the piles bear, and which alone matters, is only about 6 in. a year.

While no absolute datum such as sea level is available, a datum in a second sand stratum, about 180 ft deep, is frequently used as a basis for comparative elevations. Considerable settlement takes place between the upper and the lower sand stratum. The use of this lower datum gives rise to the mistaken idea that the streets and surface-bearing structures settle 12 in. a year faster

Examined

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This reinforced-concrete office building was under construction, and had reached eighth floor, at time of quake. It is founded on a mat hung by adjustable screws from tops of piles driven through holes in mat. Designated Ignacio Ramirez 20 from its street address (No. 11 in Fig. 1), it is in a state of total collapse.

than the buildings on piles. The *differential* settlement is 6 in., not 12 in.

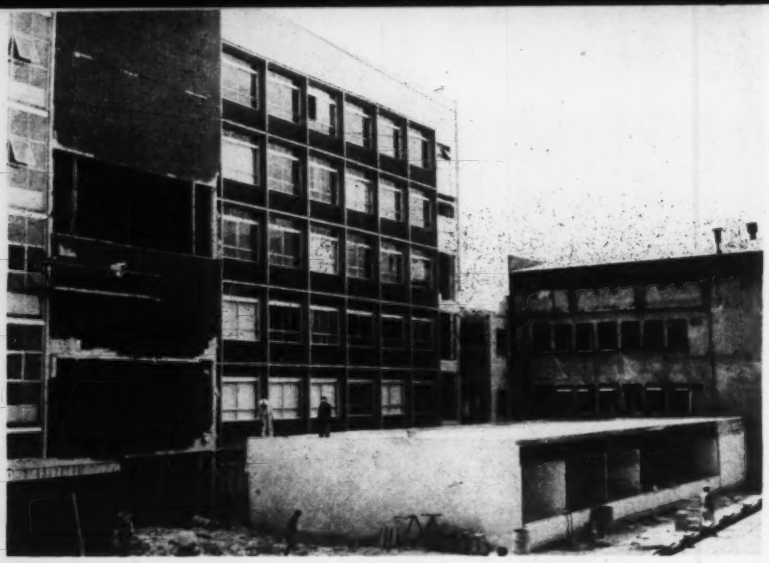
This general settlement prevails over about half the area within the city limits. Before the July quake, it had caused excessive cracking in many structures and no doubt it aggravated some of the destructive results of the quake. The surprising fact is, however, that a considerable number of buildings that had suffered earlier, partial settlement failures came through the quake with little observable additional damage. Probably this should have been anticipated, since the settlement would cause vertical stresses and strains while the earthquake shock would produce, largely, horizontal reactions.

The early newspaper reports of rubble-filled streets and collapsed buildings had some basis in fact, but to the many who had seen the ruins in Europe and Asia, even years after the bombings and shellings of the First and Second World Wars, the news stories on the Mexico City quake seemed to paint a picture altogether too dark. There is of course no basis for a close comparison between the ruins of London and Chunking and those of Mexico City. But after spending much time *inside* the damaged structures, one realizes that the difference between bomb damage and quake damage is in considerable part the difference between damage from *without* and damage from *within*. A bomb rips off the wall of a house and leaves it spilling its secrets like an empty-headed fool, but the damage from a quake, more often than not, leaves a usable looking structure, which is found on closer examination to have many fractured beams and cracked columns. We have observed hundreds of such cracks.

When an earthquake crack occurs, it nearly always goes completely through the member. It is worth remarking that to cover up the damage to a beam with a jacket of concrete will rarely restore its former capacity. Surely repairs to an earthquake cracked structure should do more than restore its strength to what it was before the injury. Obviously the original strength was inadequate since it did not prevent the damage—damage which, under the same conditions, other structures in the same neighborhood were able to resist competently. The best procedure would be to determine, in so far as possible, the differences between the structures that met the shock successfully and those that failed or partially failed under it, and to rebuild accordingly.

Turn now to the map of the City of Mexico, Fig. 1, on which are indicated, by the circled numerals, all the modern structures in the area of severe shock that we were able to examine. Brief notes on the salient features of each of these buildings, and the extent of the observed damage, follow. The paragraph numbering conforms with the numbering of the structures in Fig. 1. All these buildings have been personally examined by at least one of the writers, and generally by both. Needless to say, there has not been time to make measurements and sketches showing post-earthquake conditions in accurate detail. The information and comments are on broad, general lines.

1. Torre Latino Americana. A steel-frame skyscraper office building 43 stories high, with reinforced-concrete floors, supported on cast-in-place concrete piles of Button-Bottom type, driven to point bearing on a cemented sand stratum at a depth of about 110 ft below the curb. This building was undamaged.



This structure, Lafragua 4 (No. 6 in Fig. 1), was badly pounded by adjacent buildings. It rests on a concrete raft. Note cracked columns.

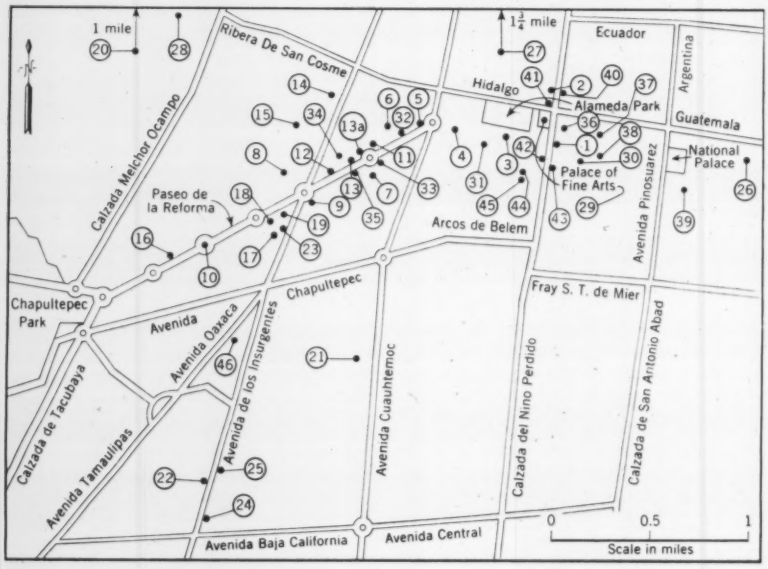


FIG. 1. Greatest damage from eathquake of July 28, 1957, occurred in heart of Mexico City, an area of about 2,500 acres. Buildings examined and described are indicated by circled numerals, which coincide with numbered paragraphs in text.

2. Aquiles Serdan 28. A reinforced-concrete office building 13 stories high, supported on sectional wood piles.

Minor cracks occurred in concrete beams, and cinder-block curtain walls were very much damaged.

3. Edificeo Inmobiliaria America. A reinforced-concrete office building 13 stories high, founded on a compensated concrete raft. The building consists of three separate masses with construction joints between them.

The three masses vibrated differently under the earthquake shock and pounded each other badly. Some cracks developed in beams and columns. Curtain walls were badly damaged. The building had settled generally before the earthquake.

4. Juarez 90. A steel office building 13 stories high with reinforced concrete floors, founded on sectional wood piles.

Structural frame and curtain walls were badly damaged.

5. Reforma 1. Reinforced-concrete office building, with 16 stories, founded on sectional wood piles.

While under construction, this building was badly wracked by an earlier earthquake. The reason given for this earlier failure was that torsional movement took place because of lack of coincidence between the dimensional center of the building and its center of gravity in a horizontal plane. Cracks were repaired with gunite—about as useful a method of repair as wrapping a bandage around a broken arm without a splint.

The July quake cracked most of the beams and columns in the fourth, fifth and sixth stories. The building was tipped badly, which widened the construction joint between it and the annex. Two elevators were knocked out of commission, leaving one in operation. The redesign presumably eliminated the original imbalance, but apparently the theory did not fit the facts for the rebuilt structure is now a hopeless wreck, and has been condemned.

6. Lafragua 4. Reinforced-concrete office building of 8 stories, with parking garage in basement, founded on a compensated raft.

Fifteen-story reinforced-concrete office building founded on sectional wood piles was left a hopeless wreck after 1957 quake. This structure, Reforma 1 (No. 5 in Fig. 1), had been damaged by an earlier quake.

This structure was badly pounded by a neighboring building owing to different periods of vibration. Beams were cracked and some columns badly damaged at top and bottom junctures with beams.

7. Versalles 15. Reinforced-concrete office building 9 stories high, supported on a concrete-mat foundation hung from precast concrete piles by yoke and screw devices.

The glass-block façade came down completely with the shock.

8. Registro Publico de la Propiedad. Reinforced-concrete government office building of seven stories, supported on concrete mat. The mat is hung by 165 adjustable screws and yokes from the tops of cast-in-place concrete piles. The holes in the mat clear the piles by 3 in.

Two beams at the first-floor level were badly cracked; other beams showed minor cracks. Some yokes fell off the piles, others were bent. Some screws were bent. Sixty of the screw-type connections were put out of commission or are entirely missing.

9. Hilton Hotel. Reinforced-concrete hotel building of 14 stories founded on sectional wood piles.

Curtain walls and decorations were badly damaged.

10. Independence Monument. This consisted of a golden angel on top of a column about 130 ft high, founded on sectional wooden piles. Since its erection, the city streets had settled 10 ft or more with respect to it.

The earthquake threw the golden angel to the ground and damaged the column at a point about one-third up from the base.

11. Ignacio Ramirez 20. This reinforced-concrete office building, with outside steel framing for windows, supported on a concrete mat with holes left for piles (to support the mat by yokes and screws), was under construction and completed up to the eighth floor at the time of the earthquake.

This building collapsed completely.

12. Roble Building and Theater. Theater and 15-story steel-frame office building with reinforced-concrete floors.

Yoke and adjustable screw devices for hanging foundation mats to tops of piles fared badly during quake.

Curtain walls in office building were severely damaged on floors three to six. The theater appears undamaged except that part of an outside wall in the balcony fell. Two elevators were put out of commission.

13. Reforma 95. Steel office building of 12 stories, with reinforced-concrete floors and walls, founded on sectional wood piles.

Curtain walls were severely damaged by the quake.

13-a. Casa Latino Americana. Steel building 13 stories high, with reinforced-concrete floors, founded on sectional wood piles. Before the shock, cracks due to differential settlement had appeared.

The shock damaged this structure at the second, third, fourth, and fifth floors. Curtain walls were damaged in most of the building, and elevators put out of commission. It is being repaired with steel cross bracing embedded in cast-in-place concrete walls.

14. Sadi Carnot 44. Under construction at the time of the earthquake, this five-story reinforced-concrete school building is founded on a concrete raft that extends 5 ft beyond the outside line of columns. Curtain walls are of red brick.

The quake damaged column-to-beam connections on the second, third, and fourth floors. Greatest damage was at the third floor. Several columns are out of plumb and one column is displaced. Floors above the third were shifted to the south and settled about 2 in.

It was not learned whether this building will be condemned.

15. Encanto Movie Theater. This building is a structural steel frame about 80 ft high, supported on a pierced concrete mat which was to be hung from concrete piles with yoke and screw connections. The connections were being installed at the time of the quake.

The quake caused the roof to fall in. This total wreck will be demolished.

16. Nilo and Reforma. This ten-story reinforced-concrete office building had stood unfinished for a long time. It is supported on a compensated concrete raft. Frame and floors had been completed. Previous to the shock the building had settled generally and was considerably out of plumb.

No further damage was observed after the quake.

17. Hamburgo and Havre. Reinforced concrete office building of seven stories on a concrete-raft foundation, completed shortly before the quake.

Quake damaged connections between columns and beams. Elevators were put out of commission at the third floor.

18. Havre 7. Reinforced-concrete office building for doctors, ten stories high, supported on compensated-concrete-raft foundation.

This building had settled generally and tilted toward the street before the quake. Both settlement and tilt were increased by the quake. Cement-block curtain walls were heavily damaged.

19. Napoles and Reforma. Under construction and nearing completion when the quake struck, this 14-story reinforced-concrete building rests on a concrete mat which is hung by yokes and screws from precast concrete piles augured down.

The top two stories totally collapsed. Minor damage occurred in the curtain walls on lower floors.

20. Polytechnical School. Several four-story reinforced-concrete buildings on compensated reinforced-concrete mats.

One building of the group collapsed entirely. Some of the remaining buildings are to be torn down. These buildings were among the most complete wrecks left by the quake. Since they belonged to the Polytechnical School, they certainly would have been designed on the basis of the latest (although obviously wrong) theories of earthquake resistant construction.

21. Frontera 125. Reinforced-concrete apartment building of six stories, on a reinforced-concrete raft.

This building collapsed completely, killing 33. The site has been cleared and is now a vacant lot.

22. Insurgentes 337. Reinforced-concrete office building of six stories on a concrete-raft foundation.

The five upper stories collapsed completely.

23. Insurgentes 51. Reinforced-concrete office building of 8 stories, originally on a compensated-concrete-raft foundation. Before the quake, the building had settled and tilted. Underpinning was under way, using precast sectional concrete piles. Piles had been augured in and adjustable yokes and screws installed on every pile, but only those in areas of greatest settlement had been tightened.

The quake came while this leveling operation was going on. The building underwent general settlement, reported to be about 6 in., and is about 8 in. out of plumb. Of the 15 piles inspected, the yokes on 10 were displaced by the quake, and other connections were severely damaged. Concrete beams were cracked on the second, third, and fourth floors—mainly on the third floor.

24. Insurgentes and Tlaxcala. Reinforced-concrete office building of ten stories, on a mat to be hung on piles by yokes and adjustable screws. Preparations to install the adjustable screws were under way before the quake.

Concrete frame and curtain walls were damaged.

25. Coahuila 223. Reinforced-concrete building of five stories on reinforced-concrete footings.

Cracks appeared in this structure and the curtain walls were badly damaged as a result of the quake.

26. La Merced Market. A large one-story market area (320,000 sq ft) with thin-shell concrete roof supported on concrete columns, each column resting

on an individual compensated concrete pontoon.

The quake collapsed 15,000 sq ft of roof.

27. Hospital de la Raza. Of heavy construction, 11 stories high, on a raft foundation. Large settlement had taken place before the quake. The raft had been underpinned and adjustable screws installed.

Quake caused serious additional damage. Screw and yoke devices were off the piles in some cases and damaged in others.

Because of the nature of the use of this building, a very careful study will have to be made, followed by reconstruction of the foundation, to avoid a major catastrophe in the event of another earthquake.

28. Escuela Normal. Several reinforced concrete buildings, of varying heights, bearing on compensated concrete rafts. The buildings had settled irregularly with resulting heavy damage before the quake.

The quake caused only minor additional damage.

29. Palace of Fine Arts. A heavy monumental steel-frame building on a massive reinforced-concrete slab. Before the quake the building had settled 11 ft below street level.

There was no apparent additional damage or settlement from the quake.

30. Bolivar 36. Steel office building with reinforced-concrete floors and curtain walls, seven stories high, founded on a conventional mat supported on long reinforced-concrete piles driven to sand stratum.

This building suffered no damage from the quake.

31. Independencia and Revillagigedo. Alffer Hotel, a ten-story reinforced-concrete building founded on precast concrete piles driven to the cemented sand stratum.

This hotel was not damaged by the quake.

32. Reforma 51. A 23-story steel-frame office building under construction and nearing completion at the time of the quake. It is founded on precast concrete piles.

Not damaged by the quake.

33. Reforma 76. An 18-story steel-frame office building founded on precast concrete piles driven to the cemented sand stratum.

Not damaged by the quake.

34. Madrid 25. A 12-story reinforced-concrete office building founded on precast concrete piles driven to the sand stratum, which was under construction and nearing completion at the time of the quake.

This structure was not damaged.

35. Reforma 104. Reinforced-concrete office building nine stories high, founded on a mat hung from piles by yokes and adjustable screws.

No damage was sustained by this building.

36. Condessa 6. Reinforced-concrete office building 11 stories high, on a compensated raft foundation.

Cement-block partition walls were slightly damaged.

37. 5 de Mayo 27. Steel-frame office building with reinforced-concrete floors, 12 stories high, founded on long sectional wood piles.

Quake caused slight damage to concrete curtain walls.

38. Palma 40. Office building eight stories high, with frame, floors and walls of reinforced concrete, founded on long sectional wood piles.

This building suffered no damage from the quake.

39. Venustiano Carranza 117. Office building of seven stories, with frame, floors and walls of reinforced concrete, on a concrete raft.

No damage was caused by the quake.

40. Aquiles Serdan 29. Office building of 13 stories, with frame and floors of reinforced concrete and red brick curtain walls, founded on sectionalized wood piles. This building had settled and was out of plumb before the quake.

It was further damaged by the quake.

41. Hidalgo 5. An 18-story steel-frame office building with reinforced-concrete floors founded on sectionalized wood piles.

Curtain walls were severely damaged by the quake.

42. San Juan de Letran 9. A 16-story reinforced-concrete office building with reinforced-concrete floors, founded on sectionalized wood piles.

Quake cracked curtain walls, particularly on the sixth and seventh floors. The building has settled out of plumb.

43. San Juan de Letran 21. A 12-story steel-frame office building with reinforced-concrete floors founded on sectionalized wood piles.

Frame, curtain walls, and stairs were cracked and otherwise damaged by the quake.

44. Plaza de Santos Degollado 10. Office building nine stories high, with reinforced-concrete frame and floors founded on sectionalized wood piles.

No damage was sustained by this building.

45. Articulo 37. A nine-story office building with reinforced concrete frame and floors, founded on sectionalized wood piles.

This building was undamaged by the quake.

46. Oaxaca 50. An 11-story office building with reinforced-concrete frame and floors on a concrete mat hung from tops of concrete piles by yokes and adjustable screws.

Yoke and screw devices failed and the building settled badly out of plumb as a result of the quake.

A few general observations

Turning again to the map, Fig. 1, the above brief reports on the structures and their condition at the time we examined them can be summarized as follows.

Seven of the structures described were supported on conventional concrete rafts which were neither compensated for soil pressure nor supported by piles. Five of these structures were damaged. Two, including the Palace of Fine Arts, were undamaged.

Eight of the structures described were supported on compensated raft foundations. All the buildings on this type of raft were damaged. These rafts were designed on the theory that a soil once subjected to a given intensity of loading, usually by a superimposed layer of soil removed before the mat is placed, will accept approximately the same intensity of loading it originally carried, when such loading is reintroduced by the weight of the mat and the building it carries.

Numerous foundation settlements in Mexico City that occurred long before the recent earthquake have disproved this theory, but it appears still to be widely accepted. In studying the settlement of many buildings on this type of foundation, both before and after this earthquake, we have found that the greatest hazard would seem to be in the necessary basic assumption that the soil below the mat will have a uniform unit load-bearing value. The irregularity of the settlements shows that this assumption is frequently in error.

Of the structures described, 15 were supported on sectional, loosely jointed wood piles. There was no possibility of directional control of the lower sections of these piles once they had been driven below the ground surface. Of the 15 buildings on this type of foundation, 12 were damaged by the quake.

Six of the structures described were founded on conventional concrete-pile-supported mats. None of the buildings on this type of foundation was damaged. Under each of these mats, piles of one of the four following types were used: (1) precast *sectionalized* concrete piles driven by standard methods, (2) piles cast in place in preexcavated holes, (3) piles formed inside predriven, removable heavy steel forming apparatus, or (4) sectionalized piles jacked down against a load supplied by the weight of the structural materials, either before or after they were built into the structure.

Ten of the structures described were supported on mats which in turn were hung on long screws mounted in pairs on the top of each pile, with their lower ends anchored in the mat. Each pile extended through an opening in the mat and was free to move. In many cases the mat, swinging like a battering ram under the influence of repeated earth shocks, kicked the yokes off the tops of the piles. All but one of the buildings on this type of foundation were damaged.

Authors' conclusions are reserved for a subsequent article.

Influence diagrams for statically determinate structures

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The practicing structural engineer often encounters statically determinate beam-type structures whose design is facilitated by the use of influence diagrams. When such structures are complicated by overlapping members, as in telescoping mechanisms or floor-system girders, the utilization of Muller-Breslau's principle is expedient for rapid construction of these diagrams. Frequently this principle is introduced when influence diagrams of statically indeterminate structures are required but is often neglected in the case of statically determinate structures. This article endeavors to emphasize the latter application.

The following statement of the principle appears in the book, *Elementary Structural Analysis*, by J. B. Wilbur and C. H. Norris, where the validity of the theorem is also demonstrated:

"The ordinates of the influence line for any stress element (such as axial stress, shear, moment, or reaction) of any structure are proportional to those of the deflection curve which is obtained by removing the restraint corresponding to that element from the structure and introducing in its place a corresponding deformation into the primary structure which remains."

If the deformation in the primary structure is a unit distortion, the resulting deflected shape is the exact scale of the influence line desired where the undeflected structure forms the base line of the diagram. When a restraint is removed from a structure that is statically determinate, the configuration resulting from the corresponding distortion will be effected by a rigid body motion of the elements. In the case of indeterminate structures, elements that cannot displace as rigid bodies undergo elastic deformation. Here, unlike the statically determinate case, the principle is limited to structures made up of elastic materials that follow Hooke's law.

A unit displacement of the point of application of a reaction in the direction of the reaction, provides an influence line for the reaction stress. If a unit rotation of one radian is introduced between the two ends of a cut section, the resulting curve is the influence line for moment at this section. To construct an influence line for the external shear at a section, the section is cut and a unit vertical displacement is provided between the two ends without relative rotation; that is, the cut ends must remain parallel.

In the statically determinate beams shown in Fig. 1, the ordinates of the vertices completely describe the influence diagrams. These ordinates may be found by evaluating the stress function when a unit load is placed at the associated abscissas, or from purely geometric considerations. All rollers are assumed to provide upward and downward reactions.

Each straight line used to construct the influence diagrams shown in Fig. 1 corresponds to a member in the structure. When a particular section is loaded, its counterpart in the influence diagram provides the desired ordinates. Structure I is loaded along the top. The influence lines are shaded under segments *AB*, *BE*, and *EG*. Structure II supports loads along the bottom. The influence lines are shaded under segments *AJ*, *JF*, and *FG*.

Consider the construction of diagram (*d*) for Structure II, for shear at *E*. Cut the middle beam at *E*. To obtain the influence diagram, a vertical displacement must be introduced

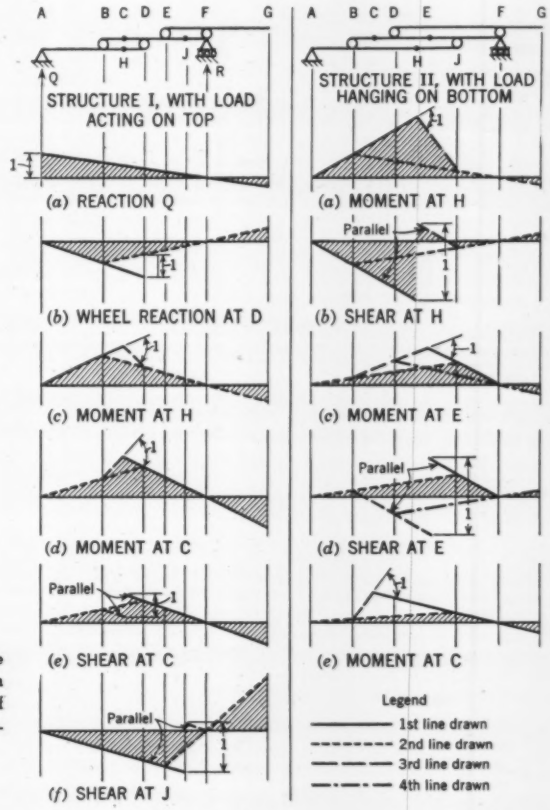

FIG. 1. Influence diagrams are drawn for two types of statically determinate structures.

between the two cut ends; for example, the right end may be displaced upward and the left end downward. To visualize the rotation of the three beam sections, assume that each rotates in one of three parallel vertical planes. Segment *EF* should be drawn first at some arbitrary inclination, because it contains one point which cannot be displaced (point *F*). Segment *BE* could not be drawn first by rotating arbitrarily about *B*, because the location of *B* depends on the inclination of *EF*. Note that if *EF* rotates through a clockwise angle, the lower beam *AJ* must rotate about the fixed point *A*, since *J* is displaced upward. Therefore the hinge at *B* is displaced upward in proportion to the vertical deflection of *J*.

The second line drawn is *AJ* using the fixed point *A* and the point *J* established by rotating *EF*. With the inclination of *AJ* established, point *B* is located. By rotating segment *BE* about *B*, a declination can be produced such that *BE* and *EF* are parallel and the two cut ends are one above the other. With *BE* so established, the hinge at point *D* is located. The final line *DG* is drawn using the fixed point *F* and the previously found point *D*. If the scale is adjusted in such a way that the vertical displacement of the cut ends is equal to unity, the figure is the influence diagram for the shear at *E*. The remaining influence diagrams shown in Fig. 1 are constructed by a similar application of Muller-Breslau's principle.

Soil moisture content quickly found

MILTON E. BENDER, Jr., A.M. ASCE

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The need for a method of determining the moisture content of a soil without waiting for the sample to dry to constant weight in an oven is evidenced by the several so-called rapid methods proposed in recent years. Each of these methods has some disadvantages. The method proposed here is simple, requires a minimum of equipment, adapts itself well to field laboratory use, gives good accuracy, and can be performed in about 15 minutes.

This method is based on the standard pycnometer specific-gravity test. The equation for determining the specific gravity of a soil is

$$G_S = \frac{W_S}{W_S - (W_T - W_B)} \quad . \quad (1)$$

where

G_S = specific gravity of soil
W_S = oven-dry weight of sample
W_B = weight of pycnometer bottle filled with water
W_T = weight of pycnometer bottle filled with sample and water

When determining the specific gravity of a soil, W_S is known. However, if G_S is known instead, the same equation and testing procedure can be used to determine W_S. Equation 1 can be written,

$$W_S = \frac{G_S}{G_S - 1} - (W_T - W_B) \quad . \quad (2)$$

For a given soil $G_S/(G_S - 1)$ is essentially constant. Therefore, Eq. 2 can be written,

$$W_S = C(W_T - W_B) \quad . \quad . \quad . \quad (3)$$

To determine W_S, Eq. 3 can be used, and the moisture content of the sample can be determined by

$$w = \frac{(W_{wS} - W_S)}{W_S} \quad . \quad . \quad . \quad (4)$$

where

w = moisture content of sample
W_{wS} = wet weight of sample

The equipment required is simple, consisting of scales sensitive to 0.01 gram, a 300- to 500-ml bottle with fitted stopper for accurate volume control, a thermometer, and a glass stirring rod.

The procedure can be broken down into five main steps.

Step 1. Determine W_B for any water temperature within the working range.

Determine the weight of the bottle and record as W_0.

Determine the weight of the bottle filled with water and the temperature of the water. Record as W_{BT_1} and T_1.

Compute values of W_B for other water temperatures by use of the following equation:

$$W_{BT_2} = (W_{BT_1} - W_0) \times \left(\frac{\text{Specific gravity of water at } T_2}{\text{Specific gravity of water at } T_1}\right) + W_0$$

Plot a curve showing the variation in W_B with temperature. This calibration curve eliminates the necessity of determining W_B for each moisture-content determination.

Step 2. Determine the constant C for Eq. 3. Two methods can be used. One is by estimating the specific gravity of the soil and then taking the ratio $G_S/(G_S - 1)$. Although the specific gravity of most soils can be estimated with little error, this method does not take into account the constant errors of this test and will usually result in a moisture content that is too high.

The second method is to run a test using an oven-dry sample and compute C. In this case C contains the constant errors of the test and therefore will give accurate moisture contents if the test procedure is standardized. This second method is practical only when a number of moisture determinations are to be made for the same type of soil. This method is particularly well suited for control of compaction in earthwork.

Step 3. Weigh the wet sample and record as W_{wS}.

Step 4. Place the sample in the bottle and add water until the bottle is about two-thirds full. Stir the contents with a glass rod for about three minutes to thoroughly disperse the soil and to allow entrapped air to escape. Finish filling the bottle with water and let it stand for about ten minutes to allow the air to come to the surface. Wash the bubbles from the surface by adding water very slowly. Insert the stopper, dry thoroughly, weigh, and record as W_T. Immediately after weighing, shake the bottle to thoroughly mix the contents, remove the stopper, and take the temperature of the mixture.

Step 5. Compute W_S from Eq. 3, using W_B for the water temperature at which W_T was determined. This method is very sensitive to temperature. It is essential that the correct value of W_B be used.

Step 6. Determine the moisture content, w, by Eq. 4.

Using this procedure, the writer has run a number of tests on various types of soil ranging from sand to very fat clay. If C is determined from an oven-dry sample, the moisture content can be determined consistently to within ± 0.3 percent. This accuracy requires only reasonable care. The results of the tests run by the writer were well within these limits for clays and even more accurate for sands. If C is evaluated by estimating the specific gravity, the error will usually be much larger — sometimes over 1 percent.

SOCIETY NEWS

ASCE to Install Nine New Officers at Annual Convention

Highlights in the Careers of Our New Officers

Louis R. Howson

Louis R. Howson, who will take office in October as the 89th President of the Society, has had a long and distinguished career in engineering and public service. He has been connected with the Chicago consulting firm of Alvord, Burdick and Howson since his graduation from college in 1908 and is now senior partner. During his many years of membership in ASCE, which he joined as Associate Member in 1914, he has served as Director (1950-1953) and Vice-President (1955-1956). He has also headed or been a member of several of its major committees.

Mr. Howson was born in Clinton, Iowa. A 1908 graduate of the University of Wisconsin, with the B.S. degree, he received the C.E. degree there in 1912 and a "Distinguished Service Citation" in 1949. He is a registered professional engineer in thirty states and several Canadian Provinces.

A nationally known specialist in sanitary engineering, Mr. Howson has served as engineer on water supplies for New York City, Chicago, Denver, Milwaukee, Cleveland, Miami, Orlando (Fla.), Dayton (Ohio), Lansing (Mich.), and a long list of other cities. Many communities, ranging from Lincoln, Nebr., to Birmingham, Ala., have similarly benefited from his services as engineer on sewerage and sewage disposal. Mr. Howson has also served as an expert on water problems for the States of New York, Pennsylvania, Ohio, Wisconsin, Michigan, and Minnesota, and as chief sanitary expert in the Lake Michigan water diversion controversy in four hearings before the U. S. Supreme Court. In addition he has aided in making studies and preparing a report for the federal government on requirements and cost of sewage treatment for the Chicago District. His services as an expert have also been sought in many court proceedings and before numerous commissions on values and rates. He has appraised more than 100 utilities and been on some thirty Boards of Arbitration.

Despite the claims of his busy career,

LOUIS R. HOWSON
President-elect of ASCE

Mr. Howson has also found time for work in many professional organizations. He is former president of the American Water Works Association and the Western Society of Engineers, and has been chairman of a number of major professional committees. Particularly important among these services was his chairmanship of the National Water Policy Committee of Engineers Joint Council. Mr. Howson is an honorary member of the AWWA and holder of four of its awards for distinguished service and achievement. He is also a member of the American Public Health Association, the American Public Works Association, the American Society of Mechanical Engineers, and the American Institute of Consulting Engineers.

For many years Mr. Howson was engineering member of the Illinois State Board of Conservation and Natural Resources, which operates the State Water Survey, the State Geological Survey, and the State National History Survey.

Waldo G. Bowman

Waldo G. Bowman, who will be new ASCE Vice-President for Zone I, is editor of *Engineering News-Record*. Mr. Bowman graduated in civil engineering from the University of Kansas and did postgraduate work at the Harvard Graduate School of Business Administration. Structural engineering design and steel erection work with the Chicago Bridge and Iron Works and the Boston Bridge Works preceded his joining the editorial staff of *Engineering News-Record* in 1925. He has been editor-in-chief since 1940.

A distinguished editor and writer, Mr. Bowman has traveled extensively throughout the United States and all over the world on construction writing and observation assignments. In 1947 he was a member of a group sent to Germany by Secretary of War Patterson to study U. S. occupation progress.

Mr. Bowman's association with ASCE began in his college days when he was first secretary and then president of the Student Chapter at the University of Kansas. He served on the Board of Direction, 1949-1951, and has been active in Metropolitan Section affairs.

Mr. Bowman is also a member of the American Society for Testing Materials and the American Concrete Institute. In addition, he has taken considerable interest in the International Commission on Large Dams, attending its congresses in New Delhi, India, and Paris, France, and is now a member of the committee arranging for the congress to be held in the United States in 1958.

WALDO G. BOWMAN
Vice-President, Zone I

SAMUEL B. MORRIS
Vice-President, Zone IV

PHILIP C. RUTLEDGE
Director, District 1

He is a registered professional engineer in the State of New York.

Samuel B. Morris

Samuel B. Morris, who recently served District 11 as Director, returns now to the Board of Direction as Vice-President for Zone IV. Widely known in West Coast water supply circles, Mr. Morris is now consulting engineer to the Los Angeles Department of Water and Power. From 1944 until about two years ago he was general manager of the department, which serves a population of well over two million.

Before taking the post with the City of Los Angeles in 1944, Mr. Morris had been dean of the School of Engineering at Stanford University since 1936 and executive head of civil engineering since 1935. He was born in Los Angeles and graduated from Stanford, with a civil engineering degree, in 1911. For 22 years he served the Pasadena Water Department as chief engineer and general manager. During this period he built Morris Dam, which was named in his honor and dedicated by Herbert Hoover in 1934.

Mr. Morris has served as consultant to several government agencies and a number of cities and utility districts. In 1950 and 1951 he was a member of the President's Water Resources Policy Commission. He has also served on the Colorado River Board of California and on the Committee on Geophysics and Geography of the Research and Development Board. Mr. Morris has also represented ASCE on the EJC National Water Policy Panel. He is a past-president of the American Water Works Association and the American Public Power Association.

Active in the Society since 1922, Mr. Morris was Director from 1954 to 1956. At local level, he has the distinction of having been president of both the San Francisco and Los Angeles Sections.

Philip C. Rutledge

Philip C. Rutledge, recently elected Director for District 1, has been a partner in the New York City firm of Moran, Proctor, Mueser & Rutledge since 1952. His work for the firm has included major responsibility for foundation investigations for projects of Kaiser Engineers all over the country; foundation studies for E. I. DuPont de Nemours, including the AEC's Savannah River Project; and a feasibility report and design of the Texas Towers Offshore Radar Stations.

A *cum laude* graduate of Harvard College in 1927, with the S.B. degree, Mr. Rutledge has an S.M. degree from M.I.T. and his science doctorate from Harvard. From 1933 to 1937 he was instructor in soil mechanics in the Graduate School at Harvard; from 1937 to 1943, associate professor and professor of soil mechanics at Purdue University; and from 1943 to 1952, professor of civil engineering and chairman of the civil engineering department at Northwestern Technological Institute. At the outset of his career he was with construction companies in New York and Boston.

As consultant to the Army Corps of Engineers, Mr. Rutledge has been a member of its Board of Consultants on Airfield Pavements since 1943; a member of its Soil Mechanics Board; and consultant to its Snow, Ice and Permafrost Research Establishment since its inception. For many years he has been identified with the work of the U.S. National Council on Soil Mechanics and Foundation Engineering, and is now on the executive committee.

Since 1947 Mr. Rutledge has been active in the work of the ASCE Soil Mechanics and Foundations Division, having served as a member and chairman of its Executive Committee. At local level, he has been vice-president and president of the Metropolitan Section.

Weston S. Evans

The new Society Director for District 2 is Weston S. Evans, a widely known engineering educator, and head of the Civil Engineering Department and acting dean of the College of Technology at the University of Maine. He received a B.S. degree in civil engineering from the University of Maine in 1918 and his M.S. degree in 1923.

After brief service in World War I, Mr. Evans joined the Great Northern Paper Co. where he stayed until his return to the University of Maine in the fall of 1920 as instructor in civil engineering. Since 1934 he has been head of the Civil Engineering Department. He was recently appointed acting dean of the College of Technology.

Joining ASCE as a member in 1935, Professor Evans was active in organizing the Maine Section in 1950 and was president of the Section in 1954. He has served on many Society committees, including the Local Qualifications Committee and the Committee on Engineering Education, of which he was chairman for three years. He has also been active in the American Society for Engineering Education, the Engineers' Council for Professional Development, and is now serving his second term on the Maine Board of Registration for Professional Engineers.

Tilton E. Shelburne

The choice of District 6 for ASCE Director is Tilton E. Shelburne, director of research for the Virginia Council of Highway Investigation and Research. Mr. Shelburne was 1955 recipient of the Highway Research Board's Roy W. Crum Award "for distinguished service" in the field of highway engineering research. His work has been most closely identified with highway materials, pavement performance, and road-surface characteristics.

WESTON S. EVANS
Director, District 2

TILTON E. SHELBURNE
Director, District 6

CRAIG P. HAZELET
Director, District 9

Following his graduation from Purdue University with the BSCE degree in 1927, Mr. Shelburne joined the Indiana Conservation Commission as a field engineer and later became district materials engineer for the Indiana State Highway Commission. He then returned to Purdue as research engineer on a cooperative project sponsored jointly by the university and the Indiana Highway Commission. While at Purdue he also resumed his academic career, taking his M.S.C.E. degree in 1939.

In 1944 the Virginia Department of Highways chose Mr. Shelburne to fill its newly created position of director of research, with headquarters at Richmond. During the next five years he worked with highway officials and educators throughout the state to set up the Council of Highway Investigation and Research. The Council was finally established at the University of Virginia in 1949. Mr. Shelburne filled numerous technical and professional committee assignments, and at present is chairman of the Highway Research Board's Department of Design. He is also author of numerous articles reporting his research activities.

Active in ASCE, Mr. Shelburne has served on the Highway Division's Committee on Significance of Tests for Highway Materials. He has also been president of the Virginia Section.

Craig P. Hazelet

The new Society Director for District 9 is Craig P. Hazelet, well known consultant and senior partner in the firm of Hazelet and Erdal, consulting engineers of Louisville, Ky. Mr. Hazelet's forty-year professional career has been chiefly concerned with the design and construction of bridges. He graduated from the University of Washington with a B.S.C.E. degree in 1915. This education was later supplemented by a C.E. professional degree from the University of Washington and graduate study at the University of Illinois and M.I.T.

In 1936 Mr. Hazelet formed Hazelet and Erdal, successor to the Scherzer Rolling Lift Bridge Company, which he had served as chief engineer, general manager, and president during the period, 1922-1936. In the course of his career, Mr. Hazelet has been engaged in the design of major bridges in China, Spain, and Canada, and numerous outstanding bridges over principal rivers in the United States. In the period 1942-1945 he served as a special consultant to the Army Transportation Corps on the design of ships, barges, and cranes. Recognition for his works was first prize in the AISC international competition for the design of an elevated highway in 1937.

Mr. Hazelet became a Member of ASCE in 1928. He has served two years on the Local Sections Committee, and four years (one of them as chairman), on the Student Chapters Committee. On similar assignments in the Department of Technical Activities, he served four years on the Executive Committee of the Structural Division, and held the post of chairman during two of those years. Still further activity of this kind involved four years as co-chairman of the ASCE-AIA Joint Cooperative Committee. At Section level he has been secretary and vice-president of the Illinois Section, and vice-president and president of the Kentucky Section.

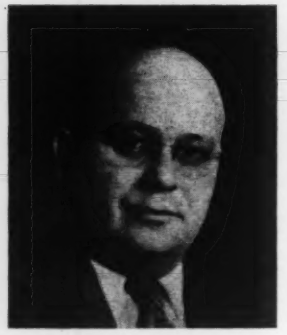
He is a member of numerous professional organizations, including the American Institute of Consulting Engineers and the U.S. Council of the International Association of Bridge and Structural Engineering.

Don H. Mattern

Don H. Mattern, chief of the Project Planning Branch of the Tennessee Valley Authority, Knoxville, Tenn., and new Society Director for District 10, has been prominently identified with the TVA since its early days. From 1934 to 1938 he was in the Design Division, engaged chiefly in hydraulic turbine test work. For part of this period he was also assistant to the chief design engineer. Since 1938 he has been in the Project Planning Branch of the Division of Water Control Planning. As chief of the Branch, he is currently responsible for preliminary investigations and economic studies for all multiple-purpose hydro and steam-electric generating developments.

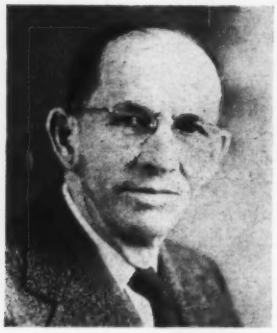
In his early career Mr. Mattern was in the Operating Department of the Consumers Power Company (Michigan) for five years. In this work he helped considerably in the development of the Index Method of hydraulic turbine testing. A 1926 graduate of Pennsylvania State University, Mr. Mattern was graduate assistant in civil engineering at Iowa State College from 1926 to 1928 while working for a master's degree in hydraulic power. He also holds the professional degree of C.E. from Iowa State, and is a licensed professional engineer in the state of Tennessee.

Long active in ASCE work, Mr. Mattern is now chairman of the Committee on Salaries and a member of the Local Qualifications Committee. He is also on the Committee on Design of the Hydraulics Division. At local level, Mr. Mattern has been president of the Tennessee Valley Section's Knoxville Branch (1949) and of the Section itself (1951). In 1949 he helped found the District 10 Council. He was managing editor of the "Tennessee Valley Engineer" in 1950 and 1951, and has been on its board of editors since 1954. Mr. Mattern was also general chairman of the Society's Knoxville Convention, held in June 1956.



DON H. MATTERN
Director, District 10

JOHN E. RINNE
Director, District 11



W. C. HUNTINGTON
Hon. M. ASCE

John E. Rinne

John E. Rinne, elected to the Board from District 11, has for the past twenty years been with the Engineering Department of the Standard Oil Company of California in San Francisco. He currently heads the Civil and Architectural Division of that department. He is a registered civil engineer and structural engineer in the state of California.

Mr. Rinne has long been active in the Society at both local and national level. In the San Francisco Section he has filled many committee assignments and has been secretary-treasurer (1945 to 1949), vice-president (1952 and 1953), and president (in 1954). Nationally, he has been active in the Structural Division, serving on its Executive Committee for the past two years and on its Publication Committee for the preceding two years.

He has also taken part in the affairs of the Structural Engineers Associations of California, having served as a director and president of both the local and state association. Mr. Rinne makes his home at Orinda in the San Francisco Bay area.

ASCE Has Four New Honorary Members

Four members of the Society will have honorary membership conferred upon them this fall. This year's elections include two distinguished foreign engineers —Dr. Karl Imhoff, of Essen, Germany, and Lorenzo Perez-Castro, of Mexico City. Three of the group will receive their citations at traditional ceremonies during the forthcoming Annual Convention in New York. Honorary membership will be conferred on Dr. Imhoff in Essen by Executive Secretary Wisely who is abroad on ASCE business this fall.

A wide range of important engineering work and professional attainment is represented in the careers of the four engineers, chosen to receive the Society's highest honor. The highlights in their careers are summarized here.

Whitney C. Huntington

New Honorary Member Whitney Clark Huntington has devoted a lifetime to the training of civil engineers, first as a teacher and later as an administrator of engineering teaching and research. For 38 years a department head, he has brought distinction to the two institutions, the Universities of Colorado and Illinois, with which he was long connected.

He was born in Denver and educated at the University of Colorado, where he received his B.S.C.E. and M.S. degrees and (later) the honorary degree of doctor of science. Following his graduation, he returned to his alma mater as an assistant in the civil engineering department and remained there until 1926—for eight years as professor of civil engineering and seven years as department head. During part of this period he also served as engineer for the Milo S. Ketchum consulting firm on a part-time basis. For eleven of his years on the University of Colorado staff Professor Huntington was in charge of the design and construction of many of the notable buildings on the campus.

In 1926 Professor Huntington joined the University of Illinois staff, where he remained as professor of civil engineering and head of the department until his retirement in 1956. As chairman of the university's building committee, he obtained a reputation for campus projects that has led other institutions of higher learning to seek his aid for their building programs. His advice was recently obtained by the U.S. Air Force in building its new Academy.

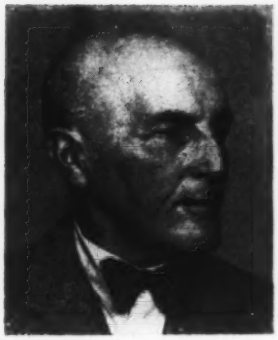
Professor Huntington's accomplishments as teacher and administrator are reflected in the tremendous development of the civil engineering department and an increase in the graduate enrollment during his tenure. He also exerted a strong influence on the policies of the Engineering Experiment Station, and gave much attention to the integration of teaching and research. During his thirty years on the University of Illinois staff annual expenditures for research in civil engineering increased from about $15,000 to about $640,000.

Since his early association with Dean Ketchum, Professor Huntington has had an abiding interest in problems of earth pressure, and is author of a definitive work in the field, *Earth Pressures and Retaining Walls*. His book, *Building Construction*, first published in 1929, is a standard text for engineering and architectural students. Among the honors that have come to him is the Alumni Medal of the University of Colorado for Distinguished Achievement, awarded him in 1947.

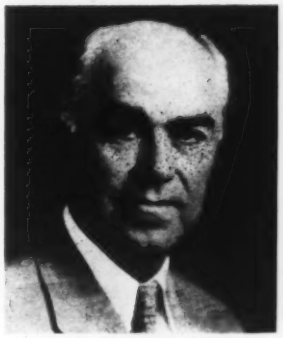
Long a member of the Society, Professor Huntington was president of the Colorado Section in 1919 and 1920 and of the Central Illinois Section in 1939.

Karl Imhoff

Dr. Karl Imhoff, new Honorary Member of the Society and a consulting engineer of Essen, Germany, is one of the world's great sanitary engineers. Fortu-



KARL IMHOFF
Hon. M. ASCE



HOWARD SCOTT MORSE
Hon. M. ASCE

nately his professional career began at Essen, one of the most populated areas in the world and an area where his genius had full scope.

He was born at Mannheim and educated at the Karlsruhe Technische Hochschule and the Munchen Technische Hochschule. He received his engineering doctorate from the Technical School at Dresden in 1905. In 1930 Karlsruhe awarded him the honorary degree of Dr. Ing., and since then he has been similarly honored by the Aachen Technische Hochschule and the Stuttgart Technische Hochschule.

In his early career he was briefly employed as engineer on the construction of bridges and harbors at Mannheim and for the Berlin Institute for Water Supply and Sewage Purification. It was in 1906 that Dr. Imhoff was appointed engineer for the Emscher Cooperative Sanitary District, and he subsequently became its engineering director. When the famous Ruhr-Verband (Ruhr District Association) was founded in 1913, he took over its engineering direction as an additional task. In 1922 he became its official business director. Since 1934 he has had a consulting practice.

In controlling the pollution of the densely populated Ruhr District, Dr. Imhoff conceived and developed the idea of materially lengthening and improving the passage time of water supplies flowing through this large industrial district. His plan involved the construction of a series of storage reservoirs, which were to receive the purified effluent from some eighty projected treatment plants. Most of these plants and numerous other installations required were constructed under Dr. Imhoff's energetic direction of the Ruhr-Verband. The chain of reservoirs ultimately became a series of picturesque lakes that have brought many recreational pleasure to the area.

Dr. Imhoff's contributions to sanitary engineering literature have been many and valuable. His famous *Taschenbuch* has gone through sixteen German editions and been translated into all principal languages. The English edition is the well-known Imhoff-Fair book on sewage treatment. In collaboration with Prof. Gordon Fair, Dr. Imhoff is also author of other widely used texts on sewage treatment.

Many honors have come to him. He is an honorary member of the American Public Health Association and the Federation of Sewage and Industrial Wastes Associations. He is also an honorary fellow of the Institute of Sewage Purification, the Institution of Sanitary Engineers, and the Institution of Public Health Engineers. In 1953 the West German Government awarded him, through its President, its "highest decoration of merit" reserved for German engineers and scientists "who have rendered non-political, humanitarian service in science and engineering."

Dr. Imhoff received his certificate of honorary membership in ASCE from Executive Secretary Wisely, who went to Essen this September to make the presentation. "In one way or another," said Mr. Wisely, in the presentation ceremonies, "his works are known and valued across the world—both within and without the fraternity of engineers." Dr. Imhoff has been a member of the Society since 1925.

Howard Scott Morse

New Honorary Member Howard S. Morse, chairman of the board of the Indianapolis Water Company, is widely known for his work in assuring fast-growing Indianapolis an adequate water supply. During his 32-year connection with the company, it has become one of the leading water works industries of the nation. Mr. Morse has served it as manager, vice-president, and president.

Born in Dedham, Mass., Mr. Morse was educated at Massachusetts Institute of Technology. He graduated in 1903 and remained there for a year as an assistant. Mr. Morse had a variety of engineering and administrative experience in his early career. He has been resident engineer for the U.S. Reclamation Service (now the Bureau of Reclamation) on irrigation projects in Montana, North Dakota and Colorado; resident engineer for the Louisville (Ky.) Commissioner of Sewerage; principal assistant engineer in charge of sewerage for the City of Cincinnati; director of the Cincinnati Bureau of Municipal Research; director of public service for Akron, Ohio; and business director of the Akron Board of Education.

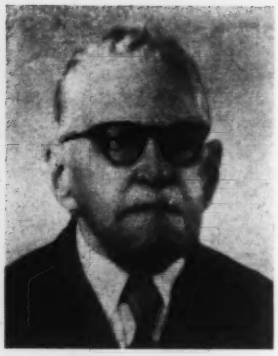
During his years with the Indianapolis Water Company, with which he became connected in 1925, Mr. Morse was the directing force behind the development of two large impounding reservoirs—one of them named in his honor. The company's distribution system grew from 549 miles in 1925 to more than 1,100 in 1956, and water usage in the city increased annually from 12 billion gallons to more than 23 billion gallons.

Keenly interested in civic projects, Mr. Morse has served as member and president of the County Council. During his term of office he ordered a salary survey to set up an equitable salary plan for county employees. He has also been president of the Indianapolis Board of Sanitary Commissioners. Among the state and local groups, to which he has given of his engineering and administrative talents, are the Advisory Committee of the Indiana Water and Sewerage Development Organization, and the Indianapolis Postwar Utilities Committee, both of which he has served as chairman; the Indiana Flood Control and Water Resources Commission; and the Legislature and Advisory Committees of the Indiana Engineering Council.

Long active in ASCE, which he joined as Associate Member in 1907, Mr. Morse was Director for District 9 from 1935 to 1938. During his term as Director he aided in the organization of the Kentucky Section. He is a former president of the Indiana Section, and currently is chairman of the Section's Advisory Committee to the Indiana Water Study Committee created by the 1955 General Assembly of Indiana. In 1952 Mr. Morse was made an honorary member of the American Water Works Association, and in 1953 he received the George Warren Fuller Award of that organization "for meritorious service in the water works field."

Lorenzo Perez-Castro

Lorenzo Perez-Castro, newly elected Honorary Member of the Society and eminent Mexico City engineer, has been



LORENZO PEREZ-CASTRO
Hon. M. ASCE

a pioneer in developing the railroad system of his country. A native of Mexico City, he received his higher education in government schools and was granted the C.E. degree from the National University in 1901. Although he did some work in his early career on school and factory construction and on hydraulics, irrigation, and drainage projects, his outstanding contribution to the engineering development of Mexico has been in transportation.

From 1902 to 1913 Mr. Perez-Castro was in the Department of Communications and Public Works, first as technical inspector and later as chief of inspection service. In 1914 he began a 26-year connection with the Mexican National Railways, which he served as assistant engineer, bridge engineer, and secretary of the board. From 1934 to his retirement in 1954 he was chief engineer of the line. Since his retirement he has been consulting engineer on railroad matters for National Fainanciera, S.A., the Mexican government financing agency.

Mr. Perez-Castro has filled many professional committee assignments, including studies of railroad accidents, laws to encourage railroad construction, technical code surveys, reorganization studies, and economic surveys. Currently he is a member of the Comision Hidrologica del Valle de Mexico, which is studying the ground-sinking and water-supply problems of Mexico City.

A member of ASCE since 1912, Mr. Perez-Castro helped organize the Mexico Section, which he served as president in 1956. His many other affiliations include the Asocicion de Ingenieros y Arquitectos de Mexico, which he served as president in 1923 and again in 1943, and of which he is now honorary president for life. He is first vice-president of the Sociedad Forestal Mexicana, and member of the Centro Nacional de Ingenieros, the Colegio de Ingenieros Civiles, the Sociedad Mexicana de Geografia y Estadistica, and the Academia Nacional de Ciencias (of which he is past-president). Mr. Perez-Castro has represented these organizations at numerous international conventions, and is a frequent visitor to the United States.

ASCE Prizes to Be Awarded During Convention

Following a long-established custom, the Society will present prizes and awards during the Annual Convention for Transactions papers considered especially significant. With the exception of the Construction Engineering Prize, which traditionally goes to an especially meritorious CIVIL ENGINEERING article, this year's awards and prizes honor papers published in Volume 121 of Transactions. The awards were announced by the Board of Direction at its Buffalo meeting, and they will be presented at the Wednesday morning ceremonies on October 16.

Norman Medal

Alfred M. Freudenthal, M. ASCE, distinguished engineering educator and consultant, is a second-time winner of the Norman Medal, oldest and most coveted of the Society's awards. His current prize-winning paper is entitled "Safety and the Probability of Structural Failure." Since 1948 Dr. Freudenthal has been professor of civil engineering at Columbia University. During this period, he has also served as research consultant to various groups—among them the U. S. Air Force, the Atomic Energy Commission, and Drilling Research Inc., a research organization of the oil industry. He is the author of numerous papers in structural engineering, applied mechanics and physics of materials. Dr. Freudenthal was awarded the 1956 Medal of the Swedish Aeronautical Society for his work in fatigue and thermal stress analysis. Last year he also organized an International Conference on Fatigue in Aircraft Structures. A native of Poland, Dr. Freudenthal was educated at the Technische Hochschule and Charles University in Prague. Before he came to the United States in 1947, he was for a number of years professor of civil engineering at the Hebrew Institute of Technology in Tel Aviv.

ALFRED M. FREUDENTHAL
Norman Medal

J. James R. Croes Medal

The J. James R. Croes Medal, the Society's second award in point of distinction, goes to **William E. Wagner,** M. ASCE, for a paper on "Determination of Pressure-Controlled Profiles." In the Bureau of Reclamation Hydraulic Laboratory since 1946, Mr. Wagner has been responsible for a wide variety of applied and basic research involving both open-channel and closed-conduit hydraulics. At present he is head of the Hydraulic Equipment Unit of the Hydraulic Laboratory. He holds degrees from Colorado State College and the University of Colorado.

Thomas Fitch Rowland Prize

There were three collaborators on the paper on "Design of Aluminum Alloy Beam-Columns," which has been awarded the Thomas Fitch Rowland Prize. They are **Harry N. Hill,** M. ASCE; **Ernest C. Hartmann,** M. ASCE; and **John W. Clark,** J.M. ASCE. From 1927 to 1955 **Mr. Hill** was with Aluminum Research Laboratories, first as research engineer and later as assistant chief of the Engineering Design Division. Since 1955 he has been chief of the Engineering Design Division of Alcoa Research Laboratories. Mr. Hill is chairman of the Executive Committee of the Engineering Mechanics Division. **Mr. Hartmann** has a similar background, having been with Aluminum Research Laboratories for 26 years as research engineer and chief of the Engineering Design Division. At present he is assistant director of research for the Alumi-

WILLIAM E. WAGNER

J. James R. Croes Medal

HARRY N. HILL

ERNEST C. HARTMANN

JOHN W. CLARK

Co-winners of Thomas Fitch Rowland Prize

num Company of America. Mr. Hartmann is no stranger to Society prizes, having won the J. James R. Croes Medal in 1938. **Dr. Clark** is assistant chief of the Engineering Design Division of Alcoa Research Laboratories, with which he has been connected since 1947. He has bachelor and master's degrees from Purdue and a Ph.D. from the University of Pittsburgh. All three have many published papers to their credit.

James Laurie Prize

"The Vibrations of Steel Stacks" is the title of the paper winning the James Laurie Prize—the joint work of **Walter L. Dickey** and **Glenn B. Woodruff,** both members of ASCE. As a specialist in structural engineering, **Mr. Dickey** has done considerable work in earthquake design and investigation, harbor and waterfront development, the design of thin shell structures, and the use of vacuum concrete. As chief structural engineer in the Power Division of the Bechtel Corporation, he was responsible for the structural design of the heavy industrial facilities described in the prize-winning paper. At present Mr. Dickey is structural engineer for the Wailes Precast Concrete Corporation, of Sun Valley, Calif. Co-author **Woodruff,** a partner in the San Francisco consulting firm of Woodruff & Sampson, is a distinguished bridge engineer. As principal assistant engineer for Ralph Modjeski and his various firms for seven years, he was responsible for such notable structures as the Mid-Hudson River suspension bridge, the Huey P. Long Bridge in New Orleans, and the Tacony-Palmyra Bridge across the Delaware, to mention a few. From 1931 to 1940, Mr. Woodruff played a leading part in the construction of the San Francisco-Oakland Bay Bridge, first as engineer of design and then as bridge engineer. In his many consulting capacities, he has been a consultant to the Bechtel Corporation's Power, Industrial, Refinery, and Pipe Line Divisions since 1946, and on the Board of Consulting Engineers for the Mackinac Straits Bridge since 1950.

Arthur M. Wellington Prize

Two Bureau of Reclamation engineers had a hand in the paper on "Engineering Properties of Expansive Clay," which has been awarded the Arthur M. Wellington Prize. They are **Wesley G. Holtz,** M. ASCE, and **Harold J. Gibbs,** A.M. ASCE. **Mr. Holtz** has been on the Bureau of Reclamation staff ever since his graduation from the University of California in 1934. Since 1943 he has been in charge of its central earth laboratory in Denver, which performs tests on construction and foundation soils for all Bureau projects. **Mr. Gibbs** is currently head of the Special Investigations and Research Section of the Bureau's Earth Laboratory Branch. He started work with the Bureau after wartime service in the Army. He is a graduate of the University of Idaho and has a master's degree from the University of Missouri.

Rudolph Hering Medal

Three members of the California Institute of Technology engineering staff—**Alfred C. Ingersoll,** A.M. ASCE, **Jack E. McKee,** M. ASCE, and **Norman H. Brooks,** J.M. ASCE—are co-authors of a paper entitled, "Fundamental Concepts of Rectangular Settling Tanks," which is

GLENN B. WOODRUFF

WALTER L. DICKEY

Co-winners of James Laurie Prize

HAROLD J. GIBBS

WESLEY G. HOLTZ

Co-winners of Arthur M. Wellington Prize

ALFRED C. INGERSOLL

JACK E. MCKEE

Co-winners of Rudolph Hering Medal

NORMAN H. BROOKS

GEORGE E. MACDONALD

Collingwood Prize for Juniors

receiving the Rudolph Hering Medal. On the Caltech staff since 1950, **Dr. Ingersoll** is now associate professor of civil engineering. In the academic year 1954-1955 he served the Technical Cooperation Mission of the International Cooperation Administration as guest professor of applied mechanics at Bengal Engineering College in India. Dr. Ingersoll collaborated with Prof. R. L. Daugherty on the fifth edition of the widely used text, *Fluid Mechanics with Engineering Applications*, and is author of many papers. His writing first came to ASCE attention in 1942, when, as a young member of the University of Wisconsin Student Chapter, he won the Daniel W. Mead Prize for students with a paper on ethics. He holds undergraduate and graduate degrees from the University of Wisconsin. **Dr. McKee** has been professor of sanitary engineering at Caltech since 1949. Before that he was a partner in the Boston firm of Camp, Dresser & McKee. He holds a bachelor's degree from Carnegie Institute of Technology and advanced degrees from Harvard. He has to his credit numerous technical reports and some twenty published papers. **Dr. Brooks** received his doctor's degree from Caltech in 1954, and since then has been an assistant professor of civil engineering there. He has also been doing consulting work on various specialized hydraulic problems, particularly the design of diffusers for ocean outfalls, for the City of Los Angeles and the Los Angeles County Sanitation Districts. He holds A.B. and M.S. degrees from Harvard.

Collingwood Prize for Juniors

This year's winner of the Collingwood Prize for Juniors is **George E. MacDonald,** A.M. ASCE, who is honored for a paper entitled, "Surveys and Maps for Pipe Lines," written while he was still a Junior Member. Except for three years of wartime service in the Corps of Engineers, Mr. MacDonald has been with Lockwood, Kessler & Bartlett, Inc., of Syosset, N. Y., since his graduation from Brooklyn Polytechnic Institute in 1942. His work for the firm has included organizing and directing combined aerial and ground surveys in South America and the Middle East. At present he is vice-president of the firm, directing a staff of over 200.

Ernest E. Howard Award

William E. Dean, Jr., M. ASCE, of Tallahassee, Fla., receives the recently established Ernest E. Howard Award for "his outstanding contribution and pioneer work in the design and use of prestressed and post-tension reinforced concrete, particularly as related to work in bridge construction." Except for one year of general highway work in Louisiana, Mr. Dean has been with the Bridge Division of the Florida State Road Department ever since his graduation from the University of Florida in 1931. For the past ten years he has been department head in charge of the division, and he is also assistant state highway engineer. One of Mr. Dean's important contributions to the field is his chairmanship of the joint AASHO-PCI Committee, which recently designed the standard series of Highway Bridge Beams. The series has been tentatively accepted by both the Bridge Committee of the AASHO and the Prestressed Concrete Institute.

J. C. Stevens Award

Neal E. Minshall, A.M. ASCE, of Madison, Wis., is this year's recipient of the J. C. Stevens Award for his discussion of the paper, "The Box Inlet Spillway and Its Outlet." Since 1938 Mr. Minshall has been with the Department of Agriculture as project supervisor on small watershed hydrology for the states of Illinois, Iowa, and Wisconsin. The results of his studies have been presented as Technical Publications of the Soil Conservation Service and as compilations of the Watershed Hydrology Section of the Agricultural Research Service.

WILLIAM ENNELS DEAN, JR.
Ernest E. Howard Award

NEAL E. MINSHALL
J. C. Stevens Award

DAVID J. PEERY
Leon S. Moisseiff Award

CARLO SEMENZA
James W. Rickey Medal

CHARLES I. MANSUR

JOHN A. FOCHT, JR.
Co-winners of Middlebrooks Award

Leon S. Moisseiff Award

This year's winner of the Leon S. Moisseiff Award is **David J. Peery,** M. ASCE, who is honored for a paper entitled "An Influence Line Analysis for Suspension Bridges." Dr. Peery, who has been professor of aeronautical engineering at the University of Michigan since 1954, is currently with the Haller, Raymond & Brown, Inc., Division of Topp Industries, Inc., at Solana Beach, Calif., while on leave of absence from the university. From 1942 to 1954 Dr. Peery was at Pennsylvania State University as professor of aeronautical engineering and head of the department. For the past fifteen years he has also been consultant on a part-time basis in the fields of structures, fluid mechanics, dynamics and vibration of guided missiles, airplanes, suspension bridges, hydraulic turbines, and heavy machinery.

James W. Rickey Medal

In this year's award of the James W. Rickey Medal, the Society honors two of its members who have been prominent in the development of hydroelectric engineering in Italy. They are **Carlo Semenza** of Venice, who has had a brilliant career with the Societa Adriatica de Elettricita, and **Claudio Marcello,** distinguished in Milan as a consulting engineer and technical director of the Societa Edison. The two are honored for contributing "in an important manner to the science and progress of hydroelectric engineering."

Middlebrooks Award

For a joint paper on "Pile-Loading Tests, Morganza Floodway Control Structure," **Charles I. Mansur,** M. ASCE, and **John A. Focht, Jr.,** A.M. ASCE, are receiving the Middlebrooks Award. **Mr. Mansur** is vice-president and chief engineer of the Independent Wellpoint Corporation, Baton Rouge, La. He has had wide experience in the fields of sanitary engineering and soils mechanics and foundation engineering, both as an officer of the U. S. Public Health Service and with the Corps of Engineers. From 1946 until August of this year he has been with the Waterways Experiment Station, where he has served as chief of the Design and Analytical Section of the Soils Division; assistant chief of the Embankment and Foundation Branch; and chief of the Geology, Soils and Materials Branch. **Mr. Focht** was with the Waterways Experiment Station from 1947 to 1953. He then became senior soils engineer for Greer and McClelland, and is now chief of design for McClelland Engineers, soils and foundation consultants in Houston, Tex. He did his undergraduate work at the University of Texas and has a master's degree from Harvard.

Karl Emil Hilgard Prize

The Karl Emil Hilgard Hydraulics Prize, a biennial award, goes to **Donald Ross** for his paper entitled, "A Physical Approach to Turbulent Boundary-Layer Problems." For the past four years Mr. Ross has been on the Technical Laboratory staff of Bell Laboratories at Whippany, N. J. For the preceding eight years he was in the Ordnance Research Experimental Laboratory at Pennsylvania State University, partly teaching and partly working on his Ph.D. thesis. His undergraduate work was done at Harvard.

Construction Engineering Prize

The Construction Engineering Prize is in a different category from the other ASCE prizes, being awarded for the best scientific or educational article on construction printed in CIVIL ENGINEERING. This year's recipient, **John N. Newell,** M. ASCE, is honored for an article, in the September 1956 issue, entitled "Pneumatic Caisson Pier for World's Longest Pipeline Suspension Bridge." He is a two-time winner of the Construction Prize, having been similarly honored in 1952. Mr. Newell was with the Massman Construction Company, of Kansas City, Mo., on a variety of bridge foundation jobs from 1939 to 1955. Since the latter year he has been chief engineer of the Kansas City Bridge Company, engaged in bridge and marine construction work throughout the United States.

DONALD ROSS
Karl Emil Hilgard Hydraulics Prize

JOHN N. NEWELL
Construction Engineering Prize

More Knowledge of Floods Revealed During ASCE Hydraulics Conference

Since the days of Noah, and possibly even before that, man has yearned for forewarning of floods and protection from their devastation. Small wonder, then, that even a hint at procedures which promise more reliable forecasting is sure to be welcomed with enthusiasm. The enthusiasm displayed by engineers, hydrologists, and meteorologists attending the Hydraulics Division Conference, held in Cambridge, Mass., late in August, is evidence of the significance of the new data presented.

The findings reported were made available as a result of appraisal of data collected before, during, and after the costly 1955 floods in the northeastern states. The uncertainties of forecasting were emphasized by Charles S. Gilman, chief of the Hydrometeorological Section of the U.S. Weather Bureau, and D. Lee Harris, meteorologist of the Bureau. Yet both demonstrated that by extensive collection of weather data and computation of probabilities more accurate forecasting may be obtained. Rainfall was related to flood patterns and protection planning by Tate Dalrymple, A.M. ASCE, hydraulics engineer for the U.S. Geological Survey, and Elliott F. Childs, A.M. ASCE, chief of the Hydrology and Hydraulics Section of the New England Division of the Corps of Engineers.

Flood warning was not the only concern of the 300 attending this annual conference, which was held in the spectacular Kresge Auditorium on the M.I.T. campus. There was keen interest, also, in the sessions on hydraulic research, design, and studies of tidal hydraulics and sedimentation. The M.I.T. Hydrodynamics Laboratory was host for planning and display of facilities, with the Massachusetts Section of the Society and the Hydraulics Section of the Boston Society of Civil Engineers assisting and the ASCE Hydraulics Division as sponsor of the enterprise.

ASCE Hydraulics Conference is welcomed to Cambridge and M.I.T. by General Chairman Arthur T. Ippen, while President Mason Lockwood looks on.

Research Pays Off

Encouragement was given to those who devote long hours to hydraulic research as four researchers presented results of their persistence. Improved discharge characteristics for culverts by means of special hoods affixed to inlets were discussed and convincingly demonstrated by Fred W. Blaisdell, M. ASCE, of the Soil and Water Conservation Research Division of the U.S. Department of Agriculture, who made his studies at the St. Anthony Falls Hydraulics Laboratory. The design of detention tanks can be improved as a result of studies made by R. S. Kleinschmidt at Harvard and reported to the conference. Concern for the effect of the solitary wave was demonstrated by Gershon Kulin, J.M. ASCE, of the National Bureau of Standards, who discussed the results of his studies of wave action on submerged objects. Studies carried out in the M.I.T. laboratories were reported by Peter S. Eagleson, J.M. ASCE.

All research findings, of course, are brought into the field of application by the designer. Such design applications were demonstrated for butterfly valves, slide gates, and fixed cone dispersion valves by Ross L. Mahon, Paul Keim, and M. L. Dickinson, all Members ASCE, in other conference papers.

Storm surges in Narragansett Bay have been studied by R. O. Reid, who is now at Texas A & M with the Department of Oceanography. Professor Reid presented new information to the conference. In another session on tidal hydraulics, John B. McAleer and George E. Townsend, of the New England Division of the Corps of Engineers, told of hurricane planning in New England.

Sediment, Sediment, Sediment

It seems that whichever way a hydraulics engineer turns he is confronted by unwanted sediment. Years of study have gone into the "where it comes from, how it comes, what to do with it" cycle. New data accumulated in field and laboratory were presented to the conference by Ivan M. Stout and Bryce Hobbs, of the Corps of Engineers; Kenneth B. Schroeder and Thomas Maddock, of the U.S. Geological Survey; G. Robert Hall, of the Soil Conservation Service; and Norman H. Brooks, J.M. ASCE, who made his studies at California Institute of Technology.

It is expected that the papers and discussions presented at the conference will soon be available in publications of the Society.

Families Entertained

Suitable entertainment for wives and families has become a traditional Hydraulics Conference feature, and the M.I.T. conference was no exception. A committee on planned entertainment for the families—under the chairmanship of Mrs. Arthur T. Ippen, wife of the general chairman—was responsible for an enjoyable series of teas and tours and other forms of diversion.

In the realm of general entertain-

At conference banquet Toastmaster Gordon Williams presents Speaker Gail A. Hathaway. Shown with them are Chairman Ippen (second from right) and Wallace Lansford (right) chairman of the Hydraulics Division.

Will your blueprints *speed*—or stall—the job?

SLOWDOWNS on the job are inevitable when blueprints are hard to read. Worse than that—costly mistakes are only a wrong guess away.

It just doesn't pay to gamble when you can remove this hazard so easily . . . and at trifling cost. Simply ask your printroom, or local blueprinter, to make your prints from Kodagraph Autopositive Paper intermediates *instead of the original drawings.*

How does this assure you consistently legible prints? First, Autopositive intermediates keep their line crispness and density even after hundreds of printings . . . do not smudge, smear, lose graphite. Second, if your drawings are yellowed, soiled, creased, or have weak lines, the use of these photographic intermediates will enable you to produce legible prints from such "unprintable" originals . . . to clean up backgrounds, step up line contrast and density, *without retracing.*

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Graphic Reproduction Division, Rochester 4, N. Y.

New booklet is jam-packed with valuable tips on saving drafting time, protecting drawings, getting better prints.

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ment there was a banquet, which well combined instruction and entertainment. President Mason Lockwood greeted the group cordially, and Past-President Gail Hathaway spoke on "Dams and Their Influence on Ancient Civilizations." Division Chairman Wallace M. Lansford presided at this function, for which Gordon R. Williams was the general toastmaster.

Preceding and during the conference several Hydraulics Division committees held planning sessions. It took parts of three days for the Division's executive committee to conclude its order of business. Chairmen of conference committees, which assumed responsibility for planning and carrying out the program, were: Gordon R. Williams, Entertainment; James W. Daily, Finance; Ronald E. Nece, Housing; Donald R. F. Harleman, Registration and Technical Program; and Peter S. Eagleson, Publicity. Arthur T. Ippen was general chairman.

Scott Turner Wins Hoover Medal for 1957

This year's winner of the Hoover Medal is Scott Turner, a mining engineer who maintains offices in New York City. Mr. Turner, former director of the U. S. Bureau of Mines, is being honored for his "many years of outstanding public service in various capacities." Mr. Turner's mining operations have taken him all over the world, and he has served on many government missions. His wide service on professional committees has included fifteen years as chairman or member of the committee that prepared Canons of Ethics in Engineering.

Scott Turner

The Hoover Medal, which was established by the four Founder Societies in 1930 in honor of former President Herbert Hoover, the first recipient of the medal, is awarded "by engineers, to a fellow engineer, for distinguished public service." Presentation of the gold medal to Mr. Turner will take place in New York next February at the annual meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers. Mr. Turner is a past-president of the AIME, next in seniority to Mr. Hoover himself, who headed the AIME in 1920.

Tellers Canvass Ballot for 1958 Officers

New York 18, N. Y.
September 16, 1957

To the 1957 Annual Meeting
American Society of Civil Engineers:

The Tellers appointed to count the Election Ballots for Officers of the Society for 1958 report as follows:

For President

(Term October 1957-October 1958)

Louis Richard Howson	11,225
Scattering	15
Void	4

For Vice-President—Zone I

(Term October 1957-October 1959)

Waldo G. Bowman	2,303
Scattering	21
Void	0

For Vice-President—Zone IV

(Term October 1957-October 1959)

Samuel B. Morris	3,220
Scattering	15
Void	0

For Director—District 1

(Term October 1957—October 1960)

Philip C. Rutledge	806
Marcel P. Aillery	617
Scattering	2
Void	47

For Director—District 2

(Term October 1957—October 1960)

Weston S. Evans	655
Scattering	4
Void	0

For Director—District 6

(Term October 1957—October 1960)

Tilton E. Shelburne	734
Scattering	0
Void	1

For Director—District 9

(Term October 1957—October 1960)

Craig P. Hazelet	699
Scattering	2
Void	0

For Director—District 10

(Term October 1957—October 1960)

Donald H. Mattern	896
Clifford D. Williams	520
Scattering	0
Void	10

For Director—District 11

(Term October 1957—October 1960)

John E. Rinne	2,058
Scattering	4
Void	1
Ballots Counted	23,859
Ballot envelopes rejected:	
Without signature	138

Respectfully submitted

A. N. MAVROUDIS, *Chairman*

R. W. RICHARDS, *Vice-Chairman*

E. L. Antoniazzi
R. M. Baumgarten
F. H. Bielefeld
A. J. Galioto
H. W. Kramer, Jr.
R. C. Miller
G. R. Shearer
W. C. Stevens
J. D. Welch

Tellers

ASCE QUARTERLY ENGINEERING SALARY INDEX

Consulting Firms

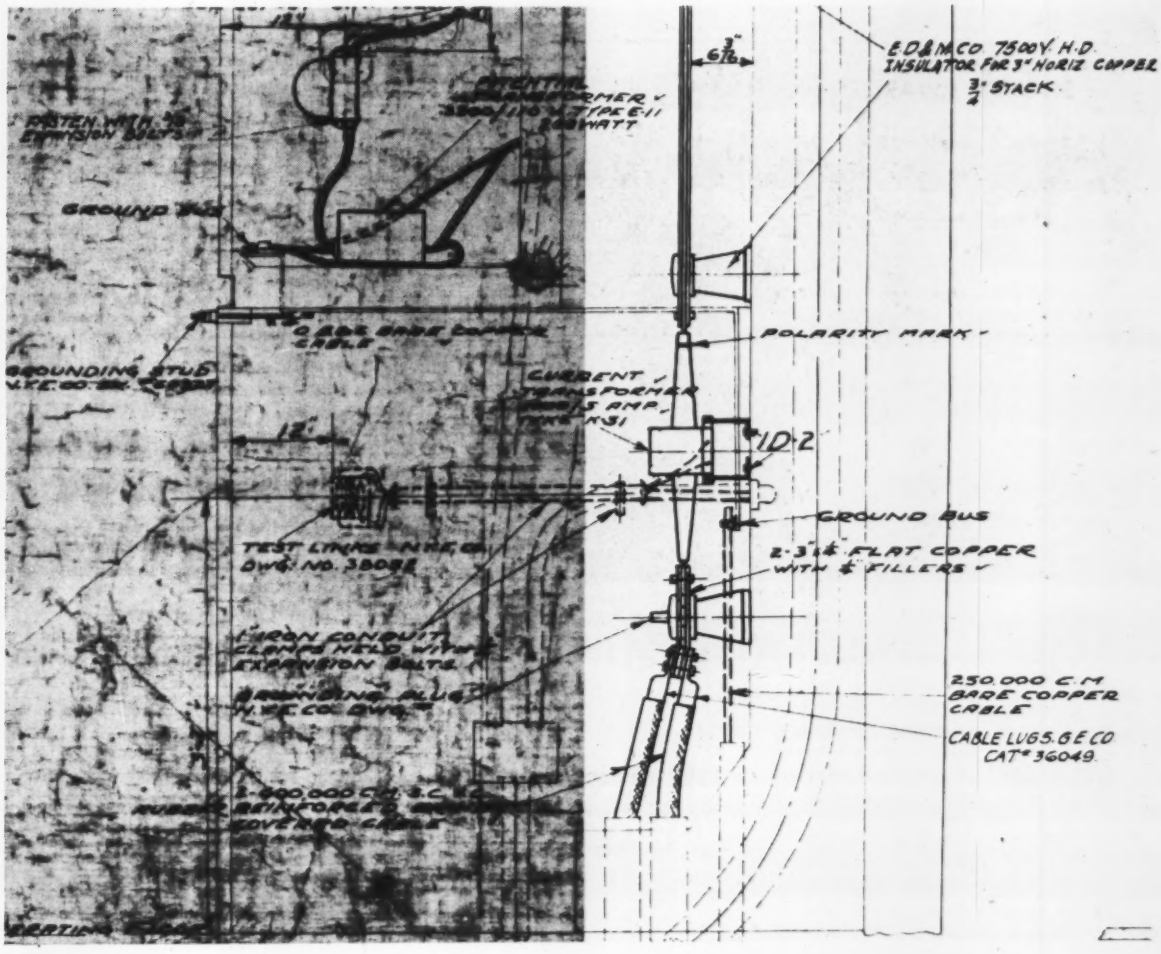
CITY	CURRENT	LAST QUARTER
Atlanta	1.11	1.10
Baltimore	1.10	1.09
Boston	1.13	1.09
Chicago	1.12	1.12
Denver	1.14	1.11
Houston	1.08	1.04
Kansas City	1.11	1.08
Los Angeles	1.16	1.14
New Orleans	(insufficient	returns)
New York	1.17	1.15
Pittsburgh	0.91	1.05
Portland	1.15	1.08
San Francisco	1.21	1.15
Seattle	1.07	1.05

Highway Departments

REGION	CURRENT	LAST QUARTER
I, New England	0.88	0.84
II, Mid. Atlantic	1.12	1.10
III, Mid. West	1.19	1.16
IV, South	1.05	1.04
V, West	0.96	0.96
VI, Far West	1.12	1.06

The ASCE Survey of Engineers' Salaries is reviewed in the July issue (page 79).

Figures are based on salaries in effect as of Aug. 15, 1957. Base figure, the sum of Federal Civil Service, G.S. Grades 5, 7 and 9 for 1956, is $15,930.



How to get better copies of your drawings

Here are two white prints spliced together for your comparison. The copy on the left was made from a sensitized cloth intermediate. This intermediate, and the print produced from it, bear the same scars of age and wear as the old original drawing.

To make the copy on the right, the worn original was reproduced on CRONAFLEX, Du Pont's amazing new engineering reproduction film. See how the CRONAFLEX intermediate has eliminated the kink marks, cleaned up the smudging, actually improved the drawing.

CRONAFLEX improves the copies of your drawings for several reasons. First, the physical characteristics of the films eliminate the kink and smudge marks from the prints. Second, the high contrast of CRONAFLEX gives you better intermediates, which means more legible blue or white prints. Third, because of the unexcelled matte surface of CRONAFLEX, you can do additional drafting or make corrections on "second originals" quickly, easily, and accurately.

CRONAFLEX engineering reproduction films are extremely versatile. They are available in three types: Direct Positive, Contact and Projection. All CRONAFLEX films are on Cronar® base, assuring unbelievable ruggedness, high dimensional stability, minimum moisture absorption.

CRONAFLEX will not tear, kink, shatter or become brittle with age or handling. CRONAFLEX has a matte finish that provides the finest pencil or ink acceptance. Lines do not smudge. Reproductions are cleaner, sharper, more legible.

Shouldn't you specify CRONAFLEX for your intermediates and "second originals"?

FOR MORE INFORMATION on CRONAFLEX, write to: E. I. du Pont de Nemours & Co. (Inc.), Photo Products Department, Wilmington 98, Delaware. In Canada: Du Pont Company of Canada (1956) Limited, Toronto.

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SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

DANIEL W. MEAD PRIZES:	*1958 contest closes May 1, 1958. See 1956 Official Register, page 132; July 1957 issue of CIVIL ENGINEERING, page 72.*
FREEMAN FELLOWSHIP:	*1958-1959 award closes May 1, 1958. See Official Register, page 142.*
J. WALDO SMITH HYDRAULIC FELLOWSHIP:	*1958-1959 award closes May 1, 1958. See Official Register, page 143.*

Advertising Office For C. E. in Chicago

Expanding the facilities of its Advertising Department, CIVIL ENGINEERING is opening a sales office in Chicago. Richard K. Holmstrom has been appointed midwestern advertising representative for the magazine in charge of the new sales office, which is located at 84 East Randolph Street, Chicago 1, Ill. Mr. Holmstrom was formerly with Dwight Early and Sons.

R. K. Holmstrom

Foreign Societies Asked to Share Engineering Center

In his post as building coordinator of the new United Engineering Center, ASME Secretary Clarence E. Davies has sailed for Europe, where he will invite representatives of thirteen foreign societies to share the facilities of the new center. Accompanying him is O. B. Schier who will take over Colonel Davies' post as secretary of ASME later this year.

According to Walter J. Barrett, president of United Engineering Trustees, Inc., "plans have been under consideration to use the Center to broaden the usefulness of the associated societies." Since the engineering profession is international in scope, he said, "the Trustees have anticipated the need for facilities to permit an even freer and more continuous interchange of engineering knowledge at a world communication center. Colonel Davies' trip to our colleagues in western Europe is occasioned by a wish to share with them our plans for the new Center and to invite them to adopt our facilities as a contact point in the United States." United Engineering Trustees will hold title to the projected new Center.

The invitation to enjoy the facilities of the new Center is being extended to engineering societies in Austria, Belgium, Denmark, Finland, France, Germany, Holland, Italy, Norway, Sweden, Switzerland, and the United Kingdom.

EUSEC Proceedings May Be Purchased

The contributions of the United States to the Third Europe-United States Engineering Conference (EUSEC), which is being held in Paris this September, have been assembled by Engineers' Council for Professional Development in a valuable 64-page volume that sells for $5.00. Engineering educators and others concerned with professional training will be especially interested in the proceedings, which cover seven different areas of U.S. participation in the thoughtful conference. Discussion ranges from a glossary of terms used in engineering education in this country to admission procedures of our engineering schools.

A coupon to aid in ordering the publication appears on page 162 of this issue.

Total Membership as of September 9, 1957

Members	9,720
Associate Members	13,185
Junior Members	17,747
Affiliates	73
Honorary Members	46
Total	40,771
(Sept. 10, 1956	39,926)

ASCE CONVENTIONS

ANNUAL CONVENTION

New York, N. Y.
Hotel Statler
October 14-18

CHICAGO CONVENTION

Chicago, Ill.
Sherman Hotel
February 24-28, 1958

PORTLAND CONVENTION

Portland, Ore.
Multnomah Hotel
June 23-27, 1958

TECHNICAL DIVISION MEETINGS

WATERWAYS & HARBORS CONFERENCE

Princeton, N. J.
October 18
(Part of Annual Convention program)

DISTRICT COUNCIL MEETINGS

DISTRICT 3 COUNCIL CONFERENCE

Syracuse, N. Y.
Drumlin's Country Club
November 23

LOCAL SECTION MEETINGS

Kansas City—The Section will be host to ten other Sections in the area for a Highway Conference at the Hotel Continental, Kansas City, Nov. 7 and 8.

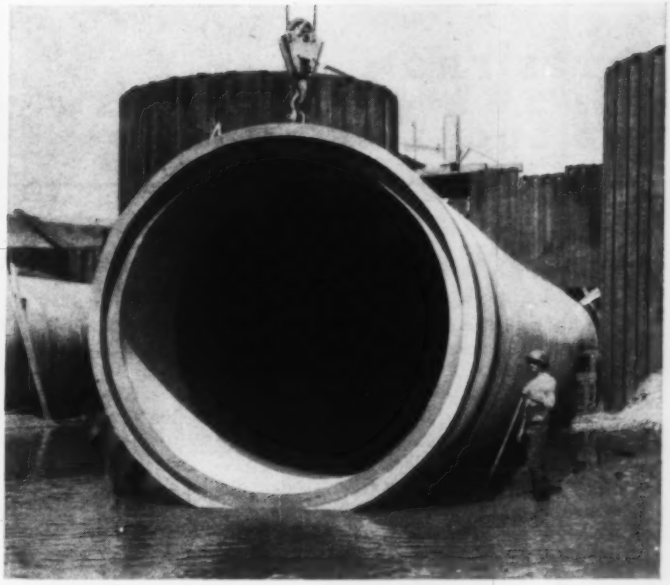
Metropolitan—Meeting in the Engineering Societies Building, November 20, at 7 p.m. Program on Consolidated Edison's Indian Point Nuclear Power Plant.

Mid-South—Annual meeting at the Hotel Marion, Little Rock, Ark., October 10-12.

Philadelphia—Dinner meetings at the Engineers Club on the second Tuesday of each month. Meetings of the Division of Hydraulics and Sanitary Engineering at the Engineers Club on the third Thursday of September, November, January, March and May.

Tennessee Valley—Annual meeting at Knoxville on November 15 and 16.

BIG



CONCRETE PIPE BY AMERICAN-MARIETTA

American-Marietta 144" reinforced concrete pipe installation used by Ohio Edison Co. for a triple discharge line over 1000 feet long at Stratton, Ohio.

A-M trucks delivering concrete pipe directly to the job site. Nationwide location of plants assures quick delivery of your order by truck, rail or barge.

Another example of
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BIG diameter reinforced concrete pipe—delivered to the job in quantity—calls for a manufacturer with BIG facilities. American-Marietta not only has the necessary equipment and engineering background to produce such pipe in quantity, but the ability to deliver it *when* and *where* needed from any of its many plants located strategically from coast to coast.

So if you're thinking BIG—about a BIG job with BIG savings in time and money—think of AMERICAN-MARIETTA COMPANY.

Our technical staff will be pleased to assist you with your pipe problems.

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CONCRETE PRODUCTS DIVISION
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101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

The **Georgia Section** initiated its fall season with a luncheon meeting on September 6. Featured speaker was Hamilton Douglas, Jr., chairman of the Redevelopment Committee of the Aldermanic Board of Atlanta, who discussed the city's urban renewal program. At a recent meeting the **Savannah Branch** heard an enlightening and timely discussion of the test results of Savannah Harbor model studies and saw a motion picture of the model. Featured speaker was John Harris, chief of Savannah Harbor Investigations and Studies Section.

The **Illinois Section** had a busy schedule this summer. Featured on the agenda at recent luncheon meetings were talks on "Michigan Avenue Bridge Repair" by Stephen J. Michuda, chief bridge engineer for the city of Chicago; "Masonry Walls Tested Using High Explosives" by Keith E. McKee, associate engineer of the Armour Research Foundation; and "Inside Iran" by Walter D. Linzing, senior engineer of the Harza Engineering Company.

All phases of planning and designing a freeway will be studied at a large regional highway conference sponsored by the **Kansas City Section** on November 7 and 8. W. A. Bugge, president of the American Association of State Highway Officials and director of highways for the State of Washington, and Maj. Gen. Louis W. Prentiss, executive vice-president of the American Road Builders Association, will be among the principal speakers. A panel discussion on planning a freeway system will be directed by Rex M. Whitton, chief engineer for the Missouri State Highway Commission. Other major speakers are Walter Johnson, Kansas state highway engineer, and M. V. Buck, regional engineer of the U. S. Bureau of Public Roads. The conference will bring together eleven sections for a thorough appraisal of design and planning problems.

On a recent trip to Bogota, President Mason G. Lockwood enjoyed the hospitality of the Republic of Colombia Section. Shown here, from left to right, are Hans Peter Jacobsen, treasurer; Jose Gomez Pinzon, vice-president; Mr. Lockwood; Alfredo D. Bateman, president, and Carlos S. Ospina, secretary.

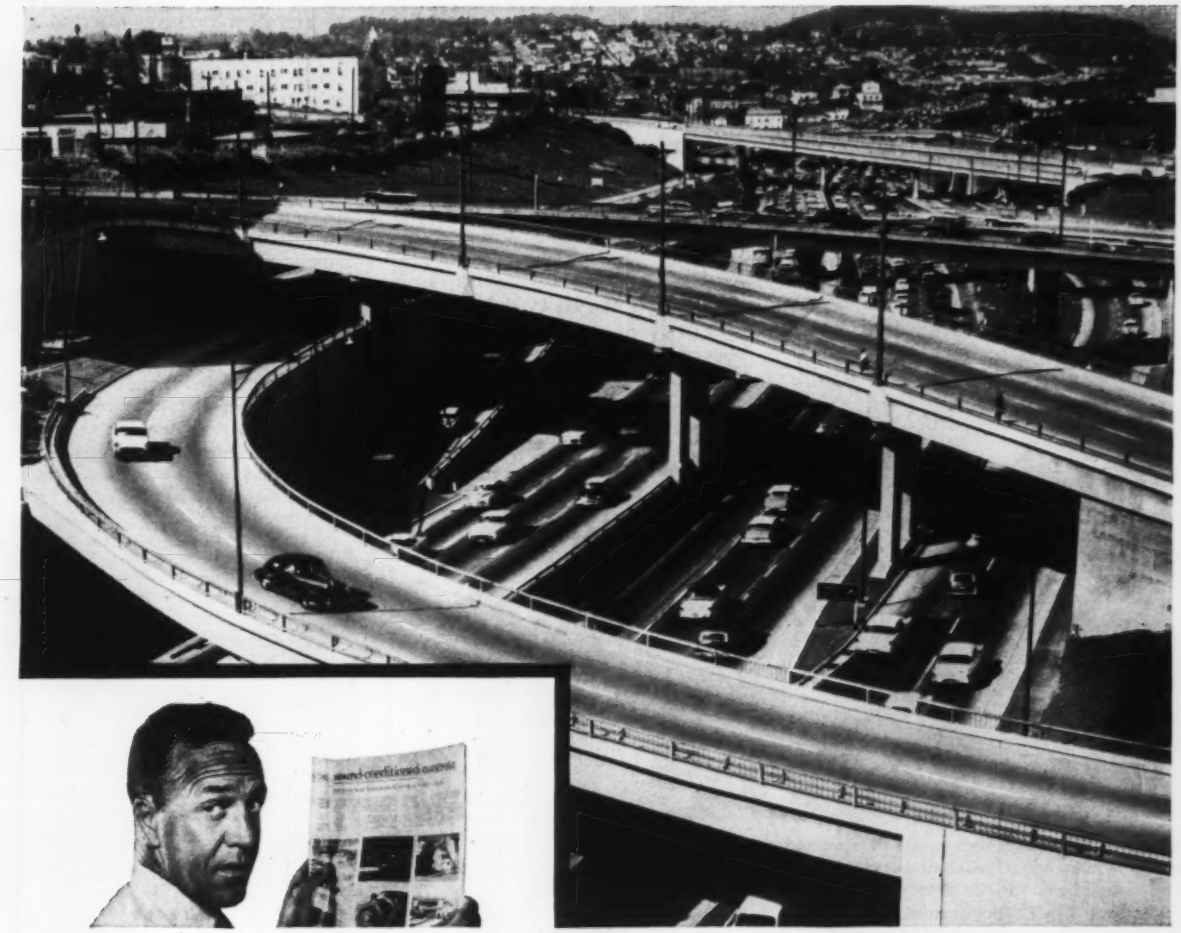
At head table at the recent Seventh Anniversary Meeting of the Maine Section, held in Southport, are (left to right) Charles F. Parker, past-president of the Section; Mrs. W. H. Wisely; Mrs. Vaughan M. Daggett; William H. Wisely, ASCE Executive Secretary; Vaughan M. Daggett, Section president; Mrs. Weston S. Evans; Miss Nancy Wisely; Mrs. Parker; and Weston S. Evans, past-president of the Section and nominee for Director of the Society. In the featured talk, Mr. Wisely discussed current Society actions.

The **Kentucky Section** is well represented in the District 9 Council this year by Floyd F. Schrader, who has been elected council chairman. Mr. Schrader is Kentucky district engineer of the Water Resources Division of the U. S. Geological Survey, and past-president of the Kentucky Section.

The **Maryland Section** resumed its monthly meetings on September 11, with Norman O. Wagner, vice-president of the Alpha Portland Cement Company, as guest speaker. Mr. Wagner's interesting talk dealt with the construction of his company's new plant at Lime Kiln, Md., and revealed unique design features.

New officers of the **Nebraska Section's Southwest Branch** are Jesse B. Budd, Jr., president; Kenneth O. Kauffman, vice-president; and Gayle E. Achterberg, secretary-treasurer. Through an error that is much regretted these officers were listed in the September issue as the Section's new slate.

At the **Northwestern Section's** first fall meeting, President J. E. Fant and Vice-President C. H. Prior outlined the events of the District Seven Conference at Grand Rapids, Minn., and the Local Sections Conference there. Speaker for the evening was Alex Campbell, general superintendent of transportation for the Great Northern Railway Company. His talk on transportation and communication with emphasis on the Red River Valley area, sparked a lively discussion from the floor. John Budd, president of the Great Northern Railway, presented



Look of the future on newest highways calls for new-type concrete. Shown, interchange in Los Angeles.

What's all this talk about

NEW-TYPE, SOUND-CONDITIONED CONCRETE FOR THE INTERSTATE SYSTEM?

It's timely talk—in a new, informative series of PCA magazine messages to create fuller appreciation by the public for the finer, smoother-riding concrete highways being built today.

Significant advances mark today's newest concrete pavement. Highway engineers know about them. (Actually you may have helped develop them.) But—the *public?* Too few know of these advances . . . now so vital on the new Interstate System.

Take *sound-conditioning.* Admittedly, not a highway engineer's term! But it literally defines what has been done to concrete by use of narrow sawed joints for contraction control. The "thump" sound is gone—a dramatic advance! Drivers enjoy a quieter ride.

There's air-entrainment, too—and the granular subbase: both solved technical problems. But by insuring a lastingly smooth, level surface, they add new pleasure to driving. These and other advances today give people a pavement that is truly *new-type.*

All this needs telling. PCA's new nationwide campaign will do that—in non-technical talk the public can understand. An informed public means an appreciative public. This can simplify your job . . . it can help speed construction of the new Interstate System.

HERE TODAY! MORE COMING!

The public is enjoying new-type, *sound-conditioned* concrete on:

Ohio Turnpike
Atlanta Expressway
Hollywood Freeway
New York Thruway

and more than 3,500 miles of other modern highways.

NEW-TYPE Concrete

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete

a stimulating extemporaneous talk on present problems of railroading.

A valuable and instructive program entitled "Steam Gaging Program in California" highlighted a recent meeting of the **San Francisco Section's** Hydraulics Division. Featured speakers were Stanley Lord, who discussed "Planning for a Balanced Program" and Charles F. Hains, whose topic was "Correlation Technique in Design of the Network." "An Engineer Sees India, Its Sanitation, Its People, and Its Customs" was the title of a revealing talk presented to the **Sanitary Division** at a recent meeting. Featured speaker was H. L. Thackwell, consulting sanitary engineer, whose trip to India last year provided material for the talk.

The **Syracuse Section** began the season with a lively dinner meeting. Speaker of the evening was Harold Anson, who described his work on precast and prestressed concrete and local operations at the Winkrete Precast Concrete Co.

Armour T. Granger, dean of engineering at the University of Tennessee, recently wrote this note to members of the **Tennessee Valley Section:** "I feel sure that members of the Tennessee Valley Section will be glad to know that this award has been so valuable to a worthy young family." The award? A $400 senior civil engineering student scholarship which the Section has just established. The recipient? Joe Thomas, a veteran and president of the Student Chapter, who has maintained better than a "B" average at the university while supporting his wife and two sons. Congratulations to Joe and the Section members who made his scholarship possible! The Junior Members of the **Chattanooga Branch** aired their views of the problems and aims of the Society at a recent meeting under the chairmanship of Gilbert Stein, Jr.

Members and guests of the Massachusetts Section met at a pleasant summer luncheon to hear President Lockwood, whose subject was "Engineers Ltd." Shown in usual order are William H. Wisely, Executive Secretary of ASCE; Frank A. Marston, ASCE Vice-President; President Lockwood; A. Russel Barnes, Massachusetts Section president; Gail Hathaway, Past-President of ASCE; Joseph Lavin on the Section's Executive Committee; and Don Reynolds of the ASCE staff.

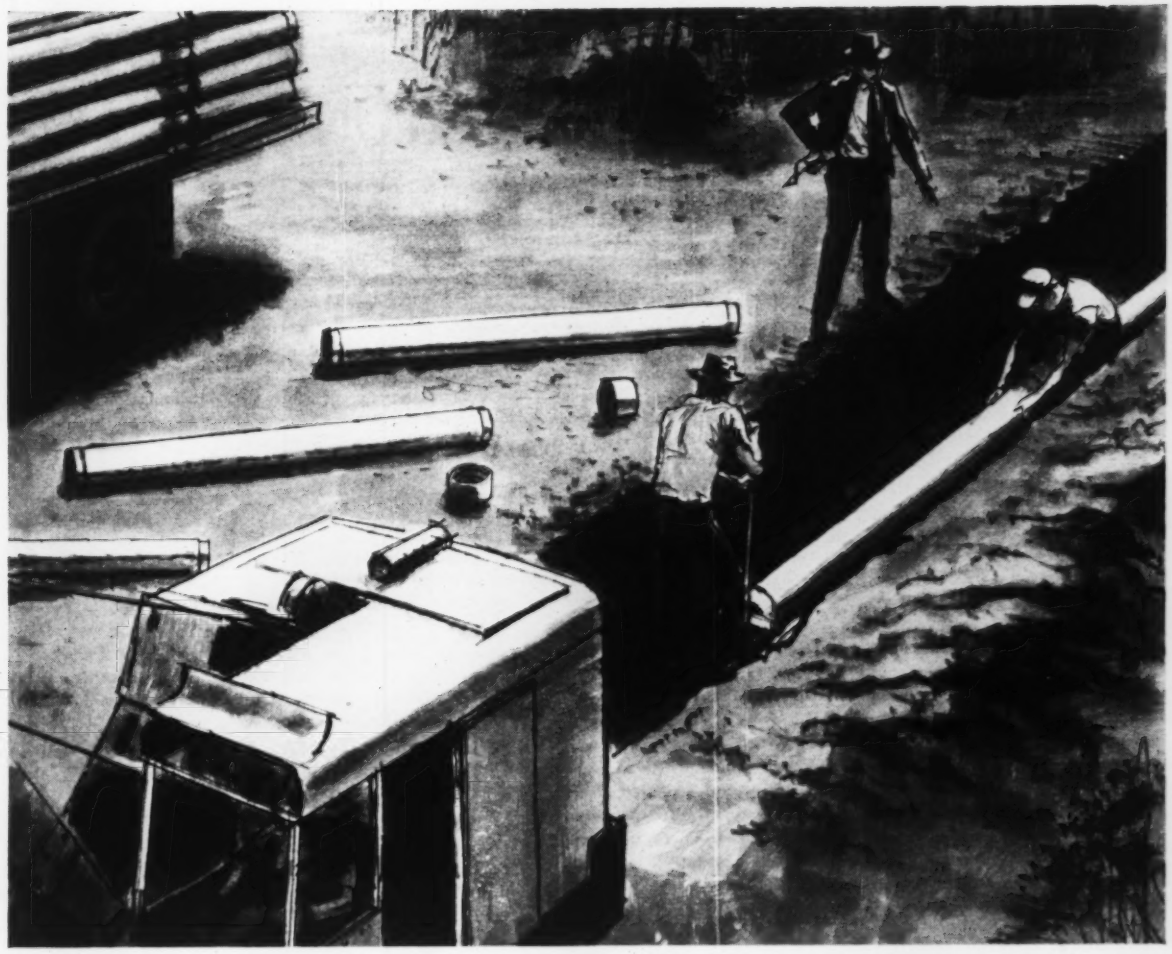
Virginia Section members enjoyed an inspection tour of the 35-mile-long Richmond-Petersburg Turnpike, scheduled for completion in April 1958. Photo shows some of the group of seventy dwarfed by the columns of the James River Bridge. Members of the Turnpike Authority acted as guides and lecturers for the tour. The bridge was designed by D. B. Steinman.

Northwestern Section Host To District 7 Council

For its summer meeting this year the District 7 Council went to Grand Rapids, Minn., where the Northwestern Section was host to the group and to a Local Section Conference. The two-day program featured tours of the Blandin Paper Mill at Grand Rapids and the famous Mesabi Range. The latter tour took off from Grand Rapids and ended at Aurora, with time out for inspection of the taconite plant at Hoyt Lakes. Mike Latimer, forester for the Blandin Paper Company, briefed the group before the paper plant tour, and there were several spokesmen for the iron ore industry. Prof. Jesse E. Fant is Council chairman.

A wide range of Local Section interests was discussed by the 26 delegates from 13 Local Sections and their Branches who met the day before the District 7 Council program. In the featured talk ASCE President Mason Lockwood congratulated the delegates on the spirit of their conference. Deploring meetings that fail to accomplish their objective, Mr. Lockwood told the group: "You are here to swap what your Section knows for what others here know about successfully running a Local Section. If we theorize that no one of the Sections represented knows as much as the others combined, this is a decided bargain for everybody. You exchange a little for a lot."

Presiding conference officers were John C. Voorhees and Frank C. Mirgain, vice-chairman and member, respectively, of the Committee on Local Sections.



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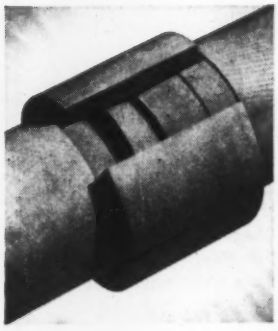

Sectional view of Ring-Tite Coupling. Ring is cut away to show how rings are compressed and locked in grooves—*a tight, lasting seal!*

Transite Pressure Pipe is lightweight and easy-to-handle . . . quickly assembled with the Ring-Tite Coupling!

With Transite® Pipe, installation crews move along fast! So fast, they consistently keep up with the excavator—installing pipe as rapidly as the trench can be opened.

Ease of handling and simplified assembly explain these advantages. Light in weight, Transite is easier to truck, easier to handle on the job. With the Ring-Tite® Coupling only simplest tools are needed for joining—pipe ends are automatically positioned within the coupling to allow for expansion.

So save while you assure your community of top economy, long trouble-free performance with Transite. For its smooth interior (flow coefficient is C=140) *often* permits selection of smaller diameter pipe . . . *always* keeps pumping costs low. And since Transite can't tuberculate, water systems can be designed without allowing for future flow reduction caused by that form of interior corrosion.

Let us send you further information on Transite asbestos-cement Pressure Pipe and the Ring-Tite Coupling. Write for booklet, TR-160A, Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

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Johns-Manville TRANSITE PRESSURE PIPE

BY-LINE WASHINGTON . . . . .

Now that Congress has adjourned, it is possible to flip through the record and review what actually was (or was not) accomplished in constructive legislation affecting the civil engineering profession and the industry of their calling—construction. This month and next, "By-Line Washington" will describe the measures passed which are of most pertinent interest to CIVIL ENGINEERING readers.

It is obvious that the highly publicized economy drive failed to halt approval of a number of big money bills promising more work for the construction industry. During the last days of the session, millions of dollars were authorized for atomic power plants, military facilities, river and harbor works, and other programs.

A good-sized atomic energy construction bill was passed. Some $253 million was authorized for land acquisition and construction of buildings, research facilities and reactors. This work will be contracted by the Atomic Energy Commission. Another $149 million was authorized for the AEC cooperative program.

(Under this latter plan, Uncle Sam will put up the money for engineering and construction of atomic reactors for power plants. The federal government will require in return that all the technical and economic data derived during the construction process and operation of the plants become public property. These facilities would be operated by private utilities and titled over to them within 10 years.)

Engineering attention will focus on the several experimental reactors and power plants to be constructed with the new money. Some large multi-million-dollar projects are involved, with peculiar design problems, and still in the experimental stage.

* * *

The old argument over public vs. private power development repeatedly dominated debate over AEC funds this session. The Atomic Energy Commission, following the party philosophy of the Eisenhower Administration, wanted to leave application of atomic energy knowledge to private enterprise. But a great many Democrats insisted that Uncle Sam provide the initiative with such construction plans.

Another important development came out of this session in regard to atomic energy construction. Hereafter, Congress gave notice, it will consider AEC projects *individually* instead of approving a total budget for the agency for use as it sees fit. Such treatment will put atomic energy facilities in the same category as other public works, exposing these projects to the same careful scrutiny . . . and to the same Congressional horse-trading . . . that determines which public works projects shall or shall not be approved.

* * *

A large public works construction bill opened the curtains on another backstage tug of war between the Democratic Congress and the Republican Administration. Both the President and the Congress have alternately assumed the pose of attempting to slash expenditures. The President was plainly discouraged when Congress laid the $858-million public works measure on his desk to be signed. He chided the legislators for appropriating money for $700 million worth of new starts which are not even in the budget. In 1958, he pointed out, the civil works construction program (by the Corps of Engineers and the Bureau of Reclamation) will include almost 500 projects costing over $9 billion in various stages of construction. Yet, in the last three years, Congress has approved $2.5-billion worth of projects outside the budget.

The Administration has not given up in its economy drive. A few days ago, the Budget Bureau instructed all agencies to turn the damper on current construction expenditures, hold them to the last year's level. (Senator Ellender of Louisiana, chairman of the Senate Public Works Subcommittee, rose up with fire in his eye when this word reached him. Referring to the request that the chief of the Corps of Engineers order new construction delays wherever possible, the Senator protested vigorously. The Administration ought to veto a bill it disagrees with and let the Congress override it, he declared, instead of attempting to defeat its objectives by administrative manipulations.)

* * *

The federal government has dumped nearly $2.9 billion more into the laps of the state highway departments for the big road-building program. Two billion dollars is for construction on the Interstate System in fiscal 1959 and $875 million for the other federal-aid systems. Secretary of Commerce Weeks apportioned the 1959 funds well in advance of the required date—next July—to make the program look as good as possible when Congress takes another look at the highway program next January. By that time, he hopes, the states will have eaten further into the big backlog of federal funds which have been made available during the past few months.

* * *

The Bureau of Public Roads has designated 2,105 miles of toll roads which, the agency believes, should be made a part of the 41,000-mile Interstate System. Almost all the new superhighways (and some old ones, notably the Pennsylvania Turnpike) were on the list. Not approved—the West Virginia Turnpike, and the Northeast Extension of the Pennsylvania Turnpike, because they do not lie on the general alignment of the System, determined in 1947.

These are the roads which (with some several thousand miles of free roads that meet System requirements) may be declared eligible for reimbursement of their construction cost. This touchy subject will be a matter of considerable debate in Congress next session. The 15 states in which the toll roads have been built, plus the other states which have also gone ahead with high-design free expressways, will undoubtedly press for reimbursement. Together they represent a mighty strong contingent of Congressmen and Senators on Capitol Hill.

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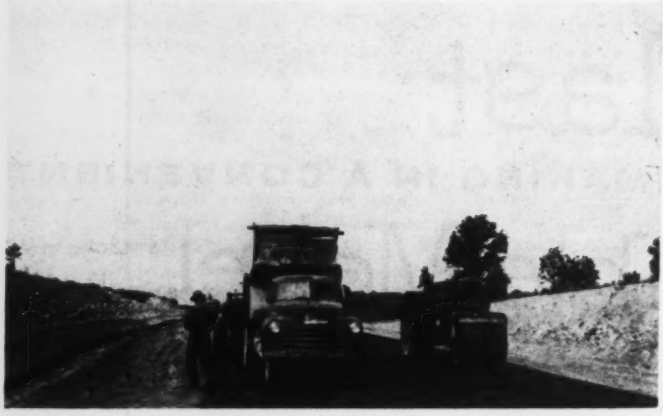
How to pave with ASPHALT

Kentucky highway's 11-inch Texaco Asphalt pavement includes insulation course, base and wearing surface

oad-mixing Rapid-curing Cutback Asphalt and aggregate for 2-inch insulation course on traffic bound subbase.



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The heavy-duty Asphalt pavement designed by Kentucky engineers for 18 miles of US-62 is one of a number of designs effectively used for major highways throughout the country.

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5. The decision of the judges is final.
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NEWS BRIEFS . . .

Construction Activity Rises in August

The value of new construction put in place rose in August to an all-time high of $4.6 billion, according to preliminary joint estimates of the U. S. Departments of Labor and Commerce. The 4 percent gain for the month was more than usual for this time of year, in contrast to the less than seasonal rise in July attributed to shortages of cement resulting from work stoppages.

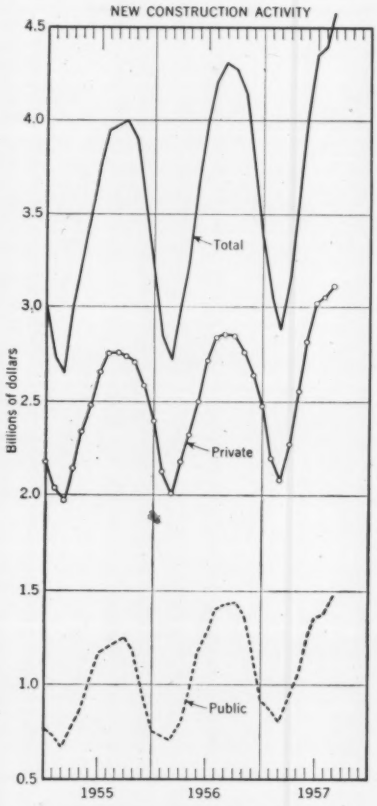
For the first eight months of this year, construction expenditures totaled a record $30.5 billion, 2 percent above last year's figure for the corresponding period. On a seasonally adjusted basis, outlays thus far in 1957 were at an annual rate of $46.8 billion, compared with actual expenditures of $46.1 billion for 1956.

A main area of strength in construction activity this year is increased spending for virtually all types of public work. Public outlays for new construction during the current January-August period—led by highways and public schools—amounted to $9 billion, 10 percent above last year's volume for the same months, and an all-time high for the period. Although public residential building is only a small category, it also has advanced significantly this year, largely because of a step-up in the Capehart military housing program.

Total private construction activity this year (at $21.5 billion) just about equalled the 1956 record for the first eight months. Outlays for public utilities rose this year to record high levels for an eight-month period, and accounted for the largest dollar gain in the private sector.

New private nonresidential building construction showed a 5 percent gain over the same period of 1956 with all-time highs set by office buildings, hospitals, and churches. The August totals for these types also were at new highs. On the other hand, outlays for new stores in both August and the first eight months were down. While industrial building showed a substantial increase for the first eight months of this year, it has been moving downward since last May (after seasonal adjustment), and outlays in July and August were lower than in 1956—the first time in two and a half years that this category was below year-earlier levels for the same months.

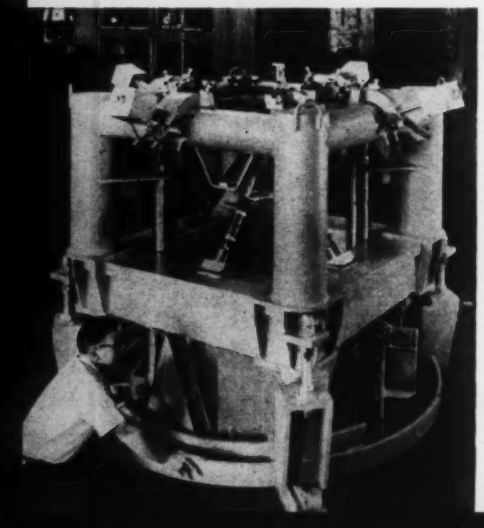
New private housing expenditures which, on a seasonally adjusted basis, declined almost continuously after July 1955, have stabilized during the past three months. In the August just passed they were 10 percent lower than a year earlier, and the January-August total this year was off 12 percent from 1956 and 20 percent from the peak year of 1955.



New construction activity rises in August after July downtrend attributed to shortages of cement.

Recess Appointment To Board of TVA

Harold R. Jones, Deputy Director of the Budget, has accepted a recess appointment to the three-man board of directors of the Tennessee Valley Authority. Mr. Jones was nominated earlier this summer for a full nine-year term to succeed Harry Curtis, whose term has expired, but his appointment still lacks Congressional confirmation. Another recess appointment must soon be made to fill the vacancy caused by the recent death of Dr. Raymond R. Paty. Herbert D. Vogel, M. ASCE, is chairman of the board.



Stand Ready for Launching Earth Satellite

Testing and firing stand, which will support the take-off of the man-made earth satellite early next year, now rises above the sands of the Cape Canaveral (Fla.) Launching Base. The stand—a cubical steel framework measuring 6½ ft on each side and mounted on top of the launching platform—is designed for both testing and launching the Vanguard, the three-stage rocket that will dispatch the earth satellite into space. About half a dozen Vanguards will be launched in an attempt to position the first man-made satellite in its orbit. The firing stand is equipped to support the rocket and hold it in a vertical position, weigh it and measure the thrust, and disconnect more than 20 fuel and instrument lines at the instant of firing. It withstands exhaust temperatures of 4000 deg F, tremendous shock and vibration, and extremely corrosive conditions. The installation was designed and built by the Loewy Hydropress Division of Baldwin-Lima-Hamilton, under subcontract from the Martin Company, Baltimore, Md.

Housing Down in August

A total of 95,000 nonfarm houses and apartments was started in August, not quite equal to the 96,000 units begun in July and 9 percent below the August 1956 total, the U. S. Department of Labor's Bureau of Labor Statistics announces. The July-to-August slackening was in public housing projects.

Private housing starts rose contraseasonally from 90,200 in July to 92,600 units in August, and the seasonally adjusted annual rate passed the million mark for the first time this year. The August rate of 1,010,000 units pushed the average annual rate for the first eight months of 1957 up to 970,000 units.

Increased private housing activity in August was confined to the metropolitan areas, where new apartment projects are buoying starts. Preliminary information, based on building-permit reports, indicates that the August rise was chiefly in the Northeastern region, where sizable gains were recorded for new apartment houses in a few large cities. Also, housing started under the FHA mortgage insurance program showed a July-to-August increase which was primarily in rental housing projects.

The overall picture shows a decline, the total of 700,500 public and private units started during the first eight months of this year being 11 percent below the comparable 1956 figure and the lowest for the period since 1949.

Ground-water Recharging at Amarillo Successful

Recharging ground water for storage purposes by pumping into wells, instead of out of them, is new but by no means unique. The City of Amarillo, Tex., faced with increasing demands for domestic water, located some of its well fields a dozen or more miles from the city. Continuing demands, resulting from population growth, peaked at quantities greater than the combined capacity of the pipe lines. The high cost of conventional storage reservoirs suggested consideration of temporary storage during off-peak months by injecting water into natural underground reservoirs near the city by recharging.

Amarillo authorities obtained the consent of the Texas Board of Water Engineers and the U. S. Geological Survey to cooperate in an investigation of the hydraulic feasibility of recharging the city-owned McDonald well field immediately southwest of, and closest to, the town. The encouraging results of study, started in 1954, were reported in Bulletin 5701 (January 1957) of the Texas Board of Water Engineers, Austin, Texas, by E. A. Moulder and D. R. Frazor, hydraulic engineers for the U. S. Geological Survey.

Conclusions reached were that, "although the ground-water reservoir has no physical lateral boundaries . . . , water moves laterally from an injection well so slowly that about 80 percent of the recharge water injected during winter months may be recovered by 'pumping during the remainder of the year." Each well tested would receive more than 1,000 gpm of water injected by gravity, and wells more than one-half mile from the point of injection were benefitted but little from a whole year of recharge operations. Determination of rates of flow and the effect of recharging in the test were made by artificially increasing the salinity of the recharge water above the natural salinity of the ground water and then making frequent identifying salinity analyses.

Interested readers may obtain Bulletin 5701 from the Texas Board of Water Engineers, 1410 Lavaca Street, Austin, Tex.

Aluminum Company Builds Underground Powerhouse in Quebec

A huge underground powerhouse, capable of generating 1,000,000 hp of electricity, is under construction by Aluminum Ltd. at Chute-des-Passes on the Peribonka River about 300 miles north of the city of Quebec. It will have five generators of 200,000-hp capacity each.

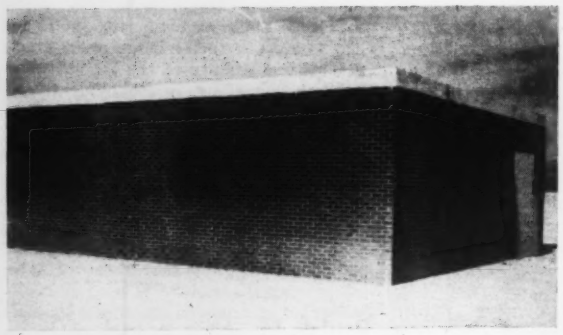
The project involves digging a six-mile tunnel, four times the length and twice the width of New York's Holland Tunnel, to the powerhouse. This tunnel, which will carry water from a storage lake to the subterranean powerhouse six miles downstream, will gradually decline to a point where the water will drop almost 636 ft vertically to the powerhouse. The rate of flow through the tunnel will be 18,000 cfs.

The Perini Construction Company, with two co-contractors, began work on the Chute-des-Passes Project in November 1956. The contractors have already completed access tunnels at three points along the route of the main tunnel, and are now excavating the main tunnel and powerhouse site. Both powerhouse and tunnel are scheduled for completion in August 1959. The total cost will be over $125,000,000.

When the project is completed, it will give Aluminum Ltd., builder also of the Kitimat, B.C., plant, 4,780,000 hp of electricity in Canada. Chute-des-Passes will be the company's sixth hydroelectric installation on the Saguenay and Peribonka rivers. The company operates smelters at Isle Maligne, Shawinigan Falls, Beauharnois and Arvida in Quebec, and the Kitimat smelter in western Canada. More than 15 percent of all primary aluminum used in the United States comes from Canada.

Nearly 400 ft underground at Chute-des-Passes, Quebec, workmen are building a tunnel four times the length of the Holland Tunnel for Aluminum Ltd. Pipes at the left are the ventilating system. Truck at right, one of many on the project, carries 19 cu yd of rock.

Reinforced Brick School Withstands Atomic Blast



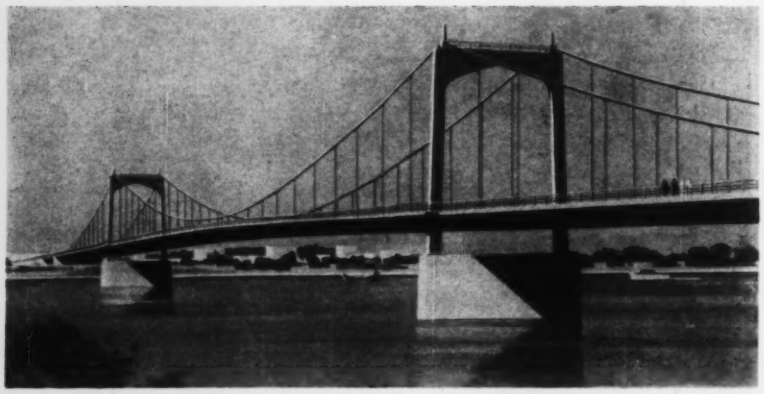
This 32 by 28-ft building with 10-in reinforced brick walls and slab reinforced concrete roof would have afforded a high degree of protection to its occupants in 75 percent of the blast area of a typical nuclear weapon.

A 32 by 28-ft brick school structure successfully withstood the effect of an atomic blast during the recent 1957 "plumbbob" nuclear test series, according to the Federal Civil Defense Administration. The structure, which was designed by the Structural Clay Products Research Foundation, was one of five under test to evaluate new reinforced brick and tile wall designs and to study wall-arching resistance to atomic blast pressures. It was also designed to resist tornadoes and earthquakes.

In its release the FCDA stated that the structure, which would be suitable for a school classroom, "survived atomic blast with no apparent damage inside or out. No cracks were noted in the walls, roof, or at any of the joints. Large enough for a typical class of thirty pupils, the building could have provided a high degree of blast protection. The structure had 10-in.-thick reinforced brick walls, a reinforced concrete flat roof and was windowless. The lack of windows is an important part of protecting building occupants . . ."

It was noted that there were no cross walls within the structure. The 32-ft side of the structure was oriented toward ground zero and designed and located for a predicted load of about 1,500 psf. "The other three walls and the roof were designed for testing at pressures of about 750 psf. Deflection gages revealed that the front wall deflected inward about a quarter of an inch and the center of the roof half an inch. However, all deflections were elastic and there appeared to be no permanent deflections."

Self-Anchored Suspension Bridge in Baghdad



Self-anchored suspension bridge, designed by D. B. Steinman, M. ASCE, consulting engineer of New York, will be built across the Tigris River at Baghdad, Iraq. One of five designs submitted by Dr. Steinman, this bridge has been selected by the Iraq Ministry of Development because of its esthetic appearance. The self-anchored design was chosen as the most economical solution to the problem of poor foundation conditions. The bridge, stiffened with box girders, will have a main span of 550 ft, with two side spans of 275 ft each. Estimated cost of the structure, including a traffic interchange and approach roads, is about $5,000,000.

Four-berth Pier to Be Built in Brooklyn

Construction of one of the biggest pier installations in the world will soon be started on the Brooklyn waterfront, according to an announcement from the New York City Department of Marine and Aviation. Representatives of the Mitsui Steamship Co., Ltd., signed a lease early in September for the construction and long-term lease of the $10,600,000 Department of Marine and Aviation shipping terminal.

The mammoth new freight terminal, which will stretch along the shoreline from 36th to 39th Streets, will be 700 ft wide and will extend 1,060 ft into Gowanus Bay, providing 13 acres of cargo-handling space. It will be able to berth four ocean-going ships simultaneously, and to accommodate 140 trucks offstreet at one time. The terminal, which will be finished late in 1959, will be an integral part of the Department of Marine and Aviation's $187,000,000 program to rebuild the New York City waterfront.

Recent congressional legislation will permit constructing the 700-ft-wide pier on solid fill instead of on wood or steel piles. A federal law, dating back to 1896, had prohibited building piers wider than 300 ft in the area and had also required that piers be built on expensive piling. As a result of the new legislation some $4,000,000 will be saved in construction costs.

Plans for the new terminal project have been designed by the New York consulting firm of Frederic R. Harris, Inc., in cooperation with John M. Buckley, A.M. ASCE, consulting engineer for the Department of Marine and Aviation; Chief Engineer Lewis H. Rabbage; Deputy Chief Engineer Joseph Halpern, and their staffs.

New Research Laboratory For Allis-Chalmers Co.

The Allis-Chalmers Manufacturing Co. recently broke ground for a new $3,250,000 engineering and research laboratory at its Harvey (Ill.) works. Part of a multi-million-dollar expansion program, the new project brings the size of the Harvey works site to 65 acres. It will provide a central engineering building, an engine and materials-handling product development laboratory, and an engine test wing. It will also include an experimental machine shop, a metallurgical laboratory, and a proving ground for materials-handling equipment. Completion of the new installation is set for next spring.

Architect and general contractor for the project is the H. K. Ferguson Co., of Cleveland, Ohio.

At Annual Meeting of EIC

Annual meeting of Engineering Institute of Canada, held at Banff Springs, Alberta, this summer, had an international flavor. Seen here, in usual order, are ASCE President Mason Lockwood; Vernon A. McKillop, then president of the EIC; T. A. Crowe, immediate past-president of the British Institution of Mechanical Engineers; and M. S. Coover, president of the American Institute of Electrical Engineers. At the conclusion of the meeting C. M. Anson, of Sydney, N. S., took office as new president of the EIC. Over a thousand attended the meeting.

Tire-Testing Ground To Be Built in Texas

A multi-million-dollar tire-testing proving ground will be built by the Goodyear Tire & Rubber Co. on 7,300 acres of rolling ranchland near San Angelo, Tex. The facility, which will be the largest of its kind in the industry, will include a banked five-mile high-speed circle; a meandering 20-mile, paved, figure-eight turnpike road; a 2½-mile straightaway for tread-wear studies of tractor tires; a 5-mile wandering gravel road and headquarters buildings.

Of particular value will be the high-banked speed circle which will permit the running of tires at excessive speeds to accelerate test results. This test circle, designed for speeds up to 160 mph, will be banked to an elevation of 7 ft. Its 30-ft-wide roadway will be made of compacted crushed rock aggregate topped with macadam. The high-speed tests will be conducted under controlled and scientific conditions. The 20-mile turnpike road, which will be designed to simulate sustained driving conditions, will have banked curves ranging from 90 to 215 deg.

Steel Production Sets Record for Eight Months

More steel was made in the first eight months of this year than in any previous identical period, according to the American Iron and Steel Institute. The record eight-month total was 78,710,279 net tons of ingots and steel for castings. The largest previous figure, 76,600,000 tons, was set in the first eight months of 1953. Last year the output for the same period was about 72,300,000 tons, reflecting the effects of the July 1956 steel strike.

In producing the record tonnage in the eight months just passed, steelmaking furnaces were operated at an average of 88.6 percent of their annual capacity (as of January 1, 1957) of 133,459,150 net tons.

This August steel production came to 9,218,000 net tons—compared with 8,908,732 tons chalked up in July and the August 1956 output of 8,122,597 tons.

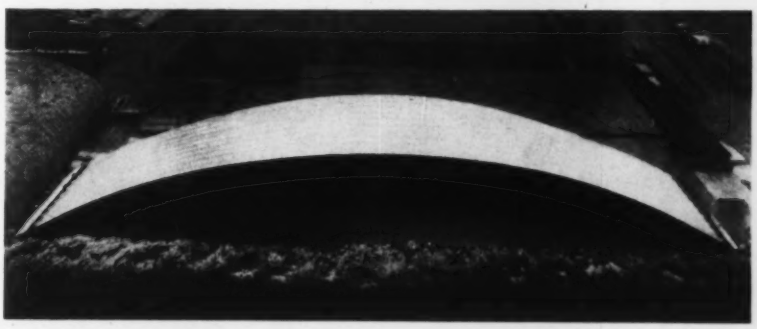
Measuring Small Angles

An evaluation of optical-reading theodolites and American-design repeating transits for measuring small angles has been completed under sponsorship of the Bureau of Engineering Research at the University of Texas. The study was made by Leland Barclay, associate professor of civil engineering.

Findings show that small angles may be measured with American-design repeating transits with a probable error of less than one second. When operated according to the manufacturer's instructions, the instrument shows no systematic errors. Small angles, when measured with the optical-reading theodolites, may have a systematic error of as much as eight seconds. The systematic error results from inaccuracies in the reading micrometer and will appear in the same way when measuring angles of any size. These conclusions are based on a study of three optical-reading theodolites.

The study and results are reported by Professor Barclay in Engineering Research Series No. 47 of the Bureau of Engineering Research. Inquiries should be sent to the Bureau of Engineering Research, University of Texas, Austin 12, Tex.

New 150-ft-Wide Steel Roof Supports Itself



Shown here is a model of the world's widest trussless steel roof—a self supporting unobstructed span of 150 ft—erected and tested at the Chicago plant site of its developer, the Wonder Building Corporation of America. Known as the "Truss-Skin" roof system, the unique structure consists of specially fabricated 14-gage steel panels, 2 ft wide by 10 ft long, secured by simple nut and bolt fasteners to form self-supporting arches. The truss-skin design completely eliminates the need for pillars, posts, purlins, trusses, or supports of any kind. Tests show the span will withstand winds in excess of 120 mph, and can support loads up to 32 psf. Cost of the span is said to be 33 percent less than similar roof structures. A number of applications of the new roof for airport buildings and other structures are in the design stage.

Advance in Power Reactors Is Rapid

Long strides are being taken in development of atomic power reactors. According to the Atomic Energy Commission's semiannual report, the development of nuclear power in the United States during the first six months of 1957 "moved further toward creating a wide technological base for economic production of electricity from nuclear fuels." The first reactor designed exclusively as a source of civilian power went critical on November 30, 1956, and was dedicated by the AEC on February 9. Located at Lemont, Ill., this reactor is a pilot plant for large commercial reactors and, since its dedication, it has been delivering up to 5,000 kw to the Argonne National Laboratory. The performance of this Experimental Boiling Water Reactor (EBWR) has been so satisfactory that its design heat output can probably be doubled.

At Santa Susana, Calif., another pilot plant reactor went critical in April of this year. The Southern California Edison Co. has arranged to take 6,500 kw of electricity from the plant, which is called the Sodium Reactor Experiment (SRE).

As reported earlier (June 1957 issue, page 96), the Army Package Power Reactor, located at Fort Belvoir, Va., has been delivering since April up to 2,000 kw of power to the lines of the Virginia Power Co. For use at Fort Belvoir, this type of pressurized water reactor could be installed to meet civilian needs in small and remote localities.

Construction of the 60,000-kw pressurized water reactor of the Duquesne Light and Power Co., at Shippingport, Pa. (October 1956 issue, pages 54-65), is scheduled to go on the line this year. This will be the first full-scale plant to be completed in the United States. It is being financed jointly by the AEC and the private utility.

Three other reactors are being financed exclusively from private utility sources: (1) a 5,000-kw boiling water reactor at Pleasanton, Calif., by General Electric and the Pacific Gas and Electric Co., is scheduled for operation this year; (2) ground has been broken by the Commonwealth Edison Co. for a 180,000-kw boiling water reactor near Joliet, Ill.; and (3) full-scale construction is under way for a 275,000-kw pressurized water reactor power plant at Indian Head, N. Y. (on the Hudson River), financed by the Consolidated Edison Co.

In summary, during the first six months of 1957 either construction permits were issued, major parts were ordered, or ground was broken for 22 reactors in the United States; 11 reactors reached criticality for the first time; and intent to build 35 other reactors was announced.

Experience with the atomic powered submarine *U.S.S. Nautilus* has been so successful that the pressurized water type of reactor was selected for the *U.S.S. Skate,* launched on May 6, and for a dozen others being built. Design and development work on nuclear power plants for a cruiser and for a destroyer is under way. Contracts for the first nuclear-powered merchant ship have been executed: (1) to design and construct the nuclear propulsion plant, awarded by AEC to Babcock & Wilcox; and (2) to design the ship itself, awarded by the Maritime Administration to George G. Sharp, Inc.

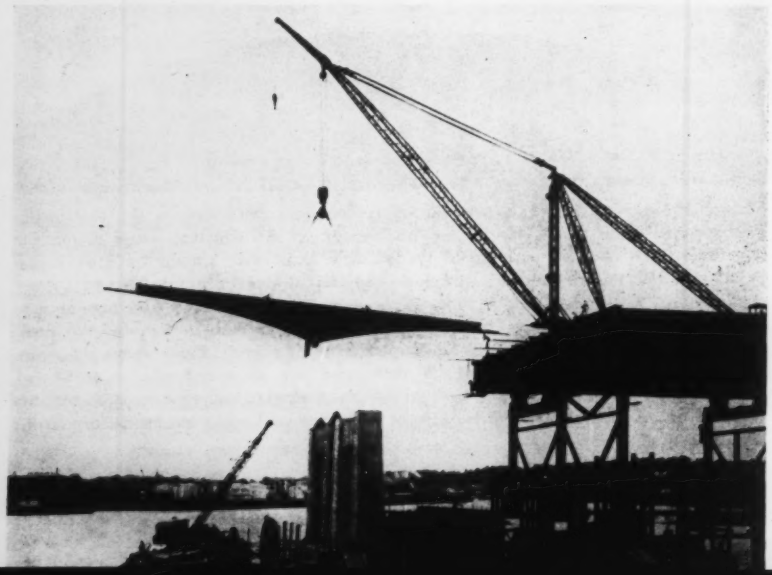
Copies of the Twenty-second Semiannual Report of the Atomic Energy Commission (July 1957) can be obtained from the AEC, Washington, D. C.

New President for ASME

A San Francisco engineering executive, James N. Landis, is the nominee of the American Society of Mechanical Engineers for its 1958 president. Mr. Landis is vice-president of the Bechtel Corporation, and a past-chairman of the ASME's San Francisco and Metropolitan sections. After a letter ballot of the membership, he will be installed during the ASME's annual meeting, to be held in New York in December.

Quinnipiac River Bridge Nears Completion

High over the waters of the Quinnipiac River at New Haven, Conn., Bethlehem Steel crews are erecting first sections of the 387-ft continuous girder span which will form the center of the Quinnipiac River Bridge. Working from the east side and using a 115-ton-capacity traveler, erection crews are hoisting haunch girder sections into position. Each is about 120 ft long and weighs 60 tons. When finished, the 3,769-ft bridge will be the longest on the entire 192-mile Connecticut Turnpike.



New York Has Its First Automatic Parking Garage

A push-button "bird cage" garage with a capacity of 255 automobiles, which is opening in New York City this September, will help theater-goers find a place to park their cars without missing the first-act curtain. The city's first automatic parking garage is an eight-story $1,000,000 structure on West 45th Street between Broadway and Eighth Avenue. Built on an 80 x 100-ft site, the reinforced concrete structure has open walls on two sides, protected by 1-in. vertical and ¾-in horizontal guard cable assemblies. In addition, each floor is reinforced with welded wire fabric.

The garage is equipped with an automatic parking system manufactured by Bowser Parking System, Inc. In this system, cars are moved horizontally and vertically on two elevators hung from moving cranes operating from the top of a central well. At the proper floor, each car can be driven into its space without having to move previously parked cars. Parking time for each car is one minute.

Gage & Morrison, of New York City, were the engineers and parking consultants in charge of the project. The general contractor was the Balaban-Gordon Company, Inc. The wire rope guard cables and other wire materials were supplied by the American Steel and Wire Division of the U. S. Steel Corporation.

Beautiful isn't it?

REINFORCED CONCRETE MADE IT POSSIBLE

YOU CAN DESIGN multiple overpasses and bridges with bold, graceful lines and soaring curves at no additional cost because of the flexibility of reinforced concrete. Other advantages of this economical method of construction are . . .

LABOR AND MATERIALS available locally . . . Structures of reinforced concrete can save months of delay because all necessary materials and labor are readily available from local sources.

LOWER IN FIRST COST . . . Time and again, comparison cost studies have proved the economy of reinforced concrete.

LOWER MAINTENANCE...no painting required. Bridges built with reinforced concrete are rugged . . . highly weather resistant.

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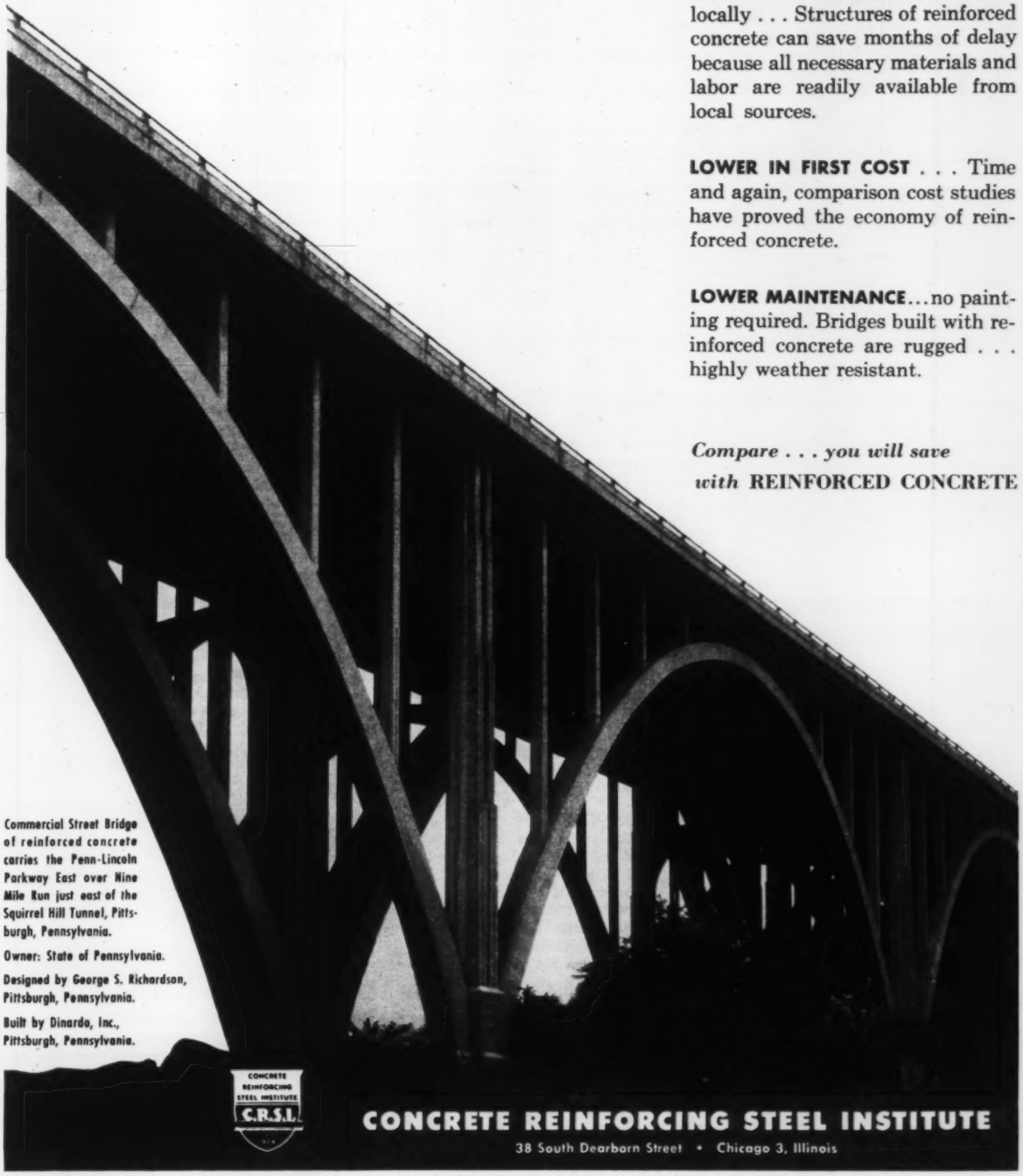


Commercial Street Bridge of reinforced concrete carries the Penn-Lincoln Parkway East over Nine Mile Run just east of the Squirrel Hill Tunnel, Pittsburgh, Pennsylvania.

Owner: State of Pennsylvania.

Designed by George S. Richardson, Pittsburgh, Pennsylvania.

Built by Dinardo, Inc., Pittsburgh, Pennsylvania.

CONCRETE REINFORCING STEEL INSTITUTE

38 South Dearborn Street • Chicago 3, Illinois

Slurry Sealing Restores Airport Runways

Slurry-sealing with Bitumuls emulsified asphalt has been used to restore 150,000 sq yd of worn and cracked pavement at Bolling Air Force Base in Washington, D. C. First, the pavement was dampened with water and a little emulsified asphalt added. A truck-mounted mixer was then operated five minutes to combine 200 gal of Bitumuls mixing-grade asphalt with five tons of sand and water as necessary for a free-flowing slurry. Photo shows a motor grader with Neoprene rubber squegee clamped to the moldboard spreading material distributed by the mixer at a rate of 3 lb per sq yd to fill cracks and leave a thin covering seal.

N. G. Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

"This should be a nice quiet evening," announced Professor Neare at the October meeting of the Engineers Club. "Listen to this note:

Dear N.G.:

I've gone to the New York Meeting of ASCE to hear a paper on Prestressed Concrete Cylinders, but anyway, you forgot to dimension BC in the Pinwheel Frame Problem. And anyhow you asked for the change in maximum shear, which has to be ¼ the tank weight for each case. Answer, 0.00.

/s/ Joe Kerr

and then this one:

Dear Noah:

Sorry to miss the meeting, but I will be in New York reading a paper on Test Cylinders for Prestressed Concrete at the Annual Meeting of ASCE. My answer to the August problem: fixing the pinwheel frame to columns reduces maximum vertical shear from 30k to 18k.

/s/ Calvin Klater

"Cal's answer is right, but just for the record, who wants to explain how he probably derived it?"

"Just the chance I've been waiting for for four years," exclaimed Ken Bridgewater. "In Fig. 1, AMBC is one of the four equal beams of the frame. Reactions R between beams at A and B are equal and opposite, so the load P at M equals the reaction at C. Location of the maximum moment, given as 252, depends on the unknown dimension BC. Letting this be b, either

$$Pb = 252 \text{ or } P(b+6) = 504 \quad . \; . \; . \; (1)$$

"Fixing the beam to the column at C introduces a clockwise end moment, which changes R, the shear diagram and the base of the moment diagram, as shown with dashed lines. Maximum moment might be at M, B or C, but only the latter leads to a solution, giving first the equation

$$P(b+6) - 12R = 163 \quad . \; . \; . \; . \; . \; . \; . \; (2)$$

and from the moment-area method equating deflections at A and B,

$$2b(P + 21 - 2R) = 16R - 5P \quad . \; . \; (3)$$

"The second option of Eq. 1 combines with Eq. 2 to find $12R = 341$, but leads to imaginary values of P and b. The other option leads to the only solution: $b = 14$, $P = 18$, $R - 197/12$. Cal's answer will now be evident from the redimensioned shear and moment diagrams."

"Just so, and no questions," ruled the Professor, "because I have to catch a plane to that same New York meeting. Here's a new one.

"A clown at the State Fair had a 25-ft 25-lb ladder with rungs every foot. Leaning it against a concrete building with its heel on concrete pavement 20 ft away, he started walking up 'no-hands', reaching the fifth rung before the ladder slithered down with a crash. Willie kicked the ladder and repeated, with the heel only 15 ft from the building, reaching the ninth rung before the ladder slithered to a super-crash. This time Willie patted the ladder gently, set it up on a 2½:1 slope, kissed the bottom rung and started up. How far did he get?"

[*Klaters and Bridgewaters were Sauer Doe (Marvin Larson), H. Francis Finch, and Ad L. Pate (G. H. Wilsey) Also, just missing last month's dead line, were correct solutions from Karl M. MacDuffie, Thatchrite (Guy C. Thatcher), and Ed. C. Holt Jr.*]

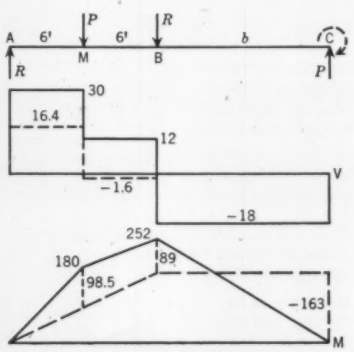
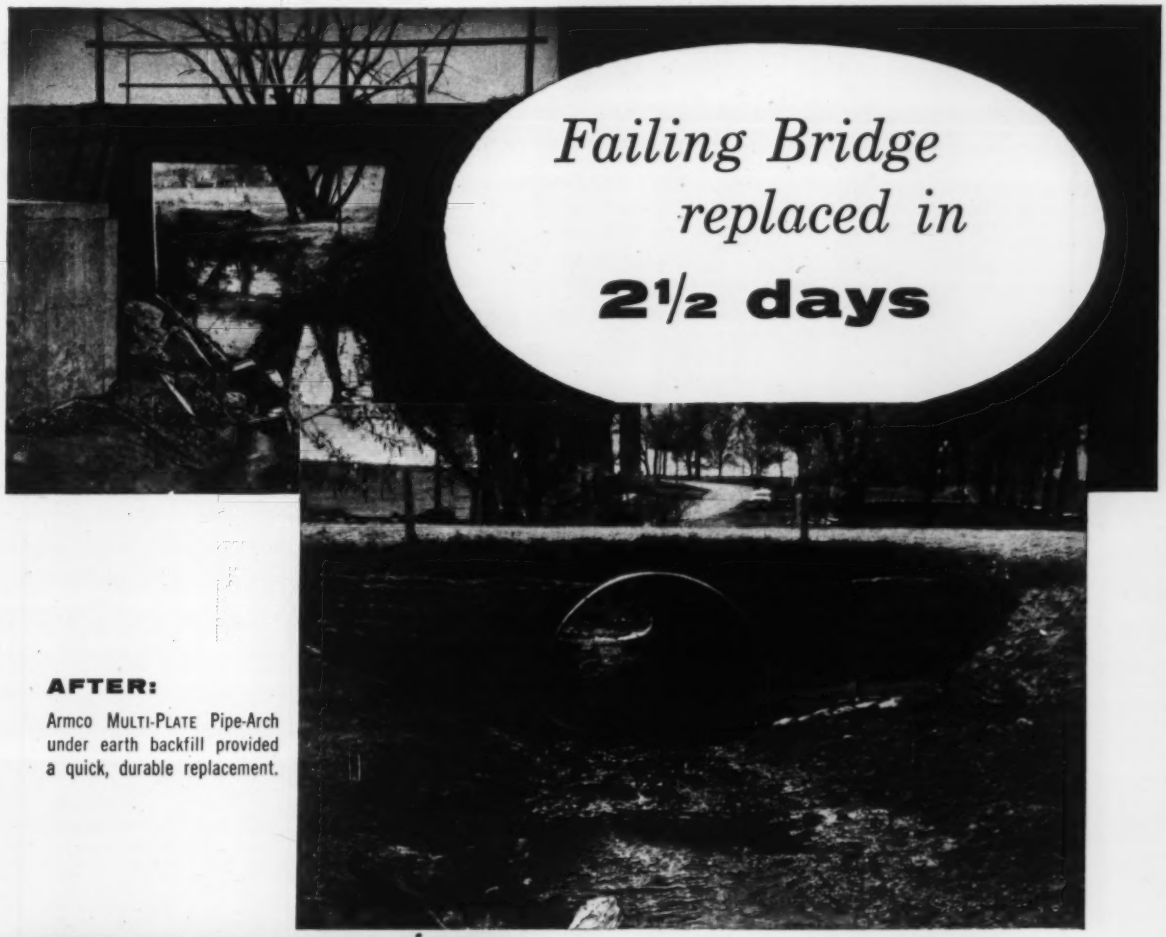


Fig. 1. Fixing Beam AC at C reduces its maximum moment from 252 at B to 163 at C, and shear from 30 in AM to 18 in BC.

BEFORE: Note how corrosive elements in the stream had eaten away the abutments of this old bridge.



AFTER:

Armco MULTI-PLATE Pipe-Arch under earth backfill provided a quick, durable replacement.

50-foot long MULTI-PLATE structure was assembled by hand beside the stream, then pulled into place.

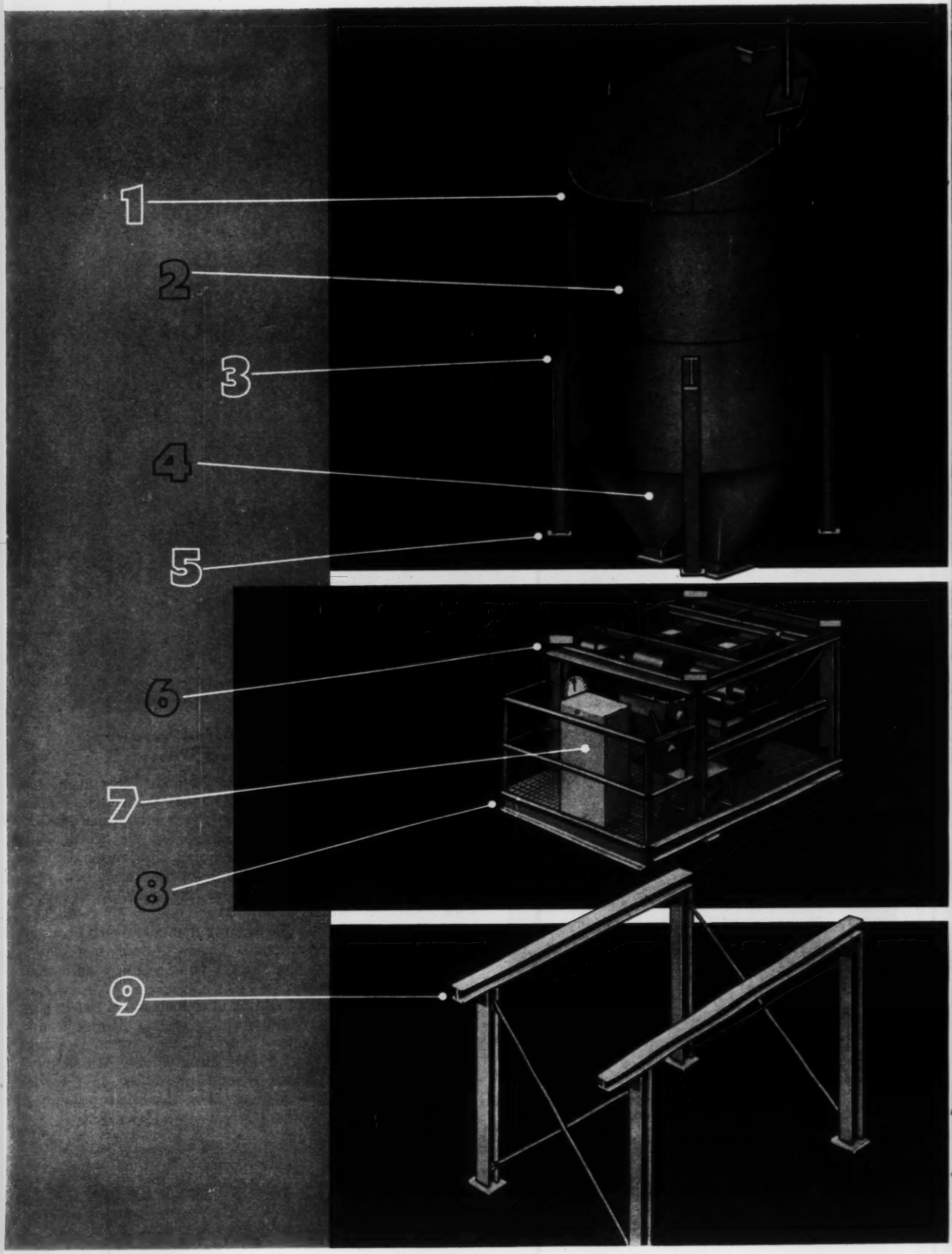
Armco Pipe-Arch allows wider roadway, heavier load limit

The abutments of this bridge in Monroe, Wisconsin, had been eaten away by corrosion. Officials decided to replace it with an Armco MULTI-PLATE® Pipe-Arch (span 8′-10″, rise 6′-1″). A four man crew assembled the 50-foot-long structure on the bank in just 12 hours. One more day was required to rip out the old bridge, level the stream bed, position the MULTI-PLATE, and place the backfill. Result: a wider, stronger bridge in only 2½ days.

MULTI-PLATE is only one of more than 30 Armco Products for drainage and construction. These products can play a time-saving, money-saving role in your highway and other construction projects.

Write for details on such Armco Products as MULTI-PLATE, Guardrail, Retaining Walls, Sheeting, Piling, Bridge Plank, Steel Buildings, and Water Control Gates. Armco Drainage & Metal Products, Inc., 5727 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

ARMCO ARMCO® **CONSTRUCTION PRODUCTS**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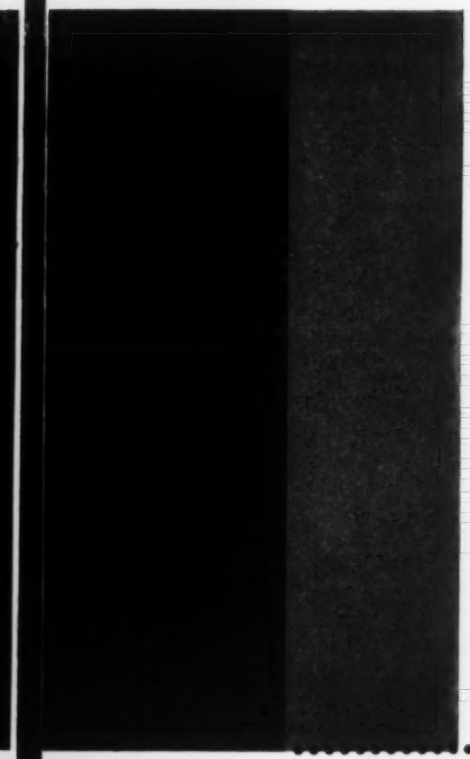

Designed especially for highway and airport work— it is the fastest, most accurate and portable plant of its kind

Heltzel's outstanding portable cement plant

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Here's the cement plant engineered specifically for the highway and airport builder to deliver specification batches as fast as they can be handled—a plant that can be erected or dismantled in minutes by a skeleton crew, transported over existing roadways on standard truck equipment.

The unitized plant is fabricated in three easy to handle sections with instantaneous couplings for manual or automatic installation. The Bin Section (1) is completely factory assembled in capacities from 230 bbl. to 670 bbl. Of all welded heavy plate construction (2) the design utilizes rugged, wide flange beam columns (3). Single or double outlet (4) available for single, dual or twin batchers. Column connectors (5) are extra large for easy spotting and rapid assembly.

Batching or intermediate section (6) comes completely assembled with single, dual or twin batchers, fully automatic or manual, including the exclusive combination gravity and rotary vane cement feeder that means much faster charging with unmatched precision or the outstanding Heltzel tubular cement valve that can't freeze-up or jam.

It features the popular ultra-high speed Heltzel weighing system (7). Where desired a factory assembled platform extension (8) with metal decking is available. Support section formed of rugged, yet easy to handle wide flange beams (9) with bracing furnished for drive through in either direction. Elevators (not shown) are manufactured to move from 150 bbls. to 500 bbls. per hour with installations for either railroad or cement truck delivery.

You'll want to know more about this portable plant that works with all the speed and accuracy of a modern stationary plant. Contact your Heltzel representative or write direct.

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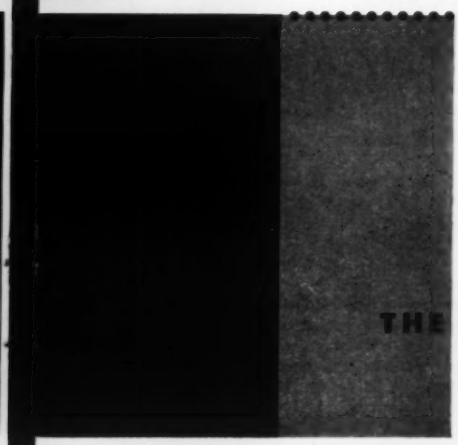

THE HELTZEL STEEL FORM AND IRON COMPANY

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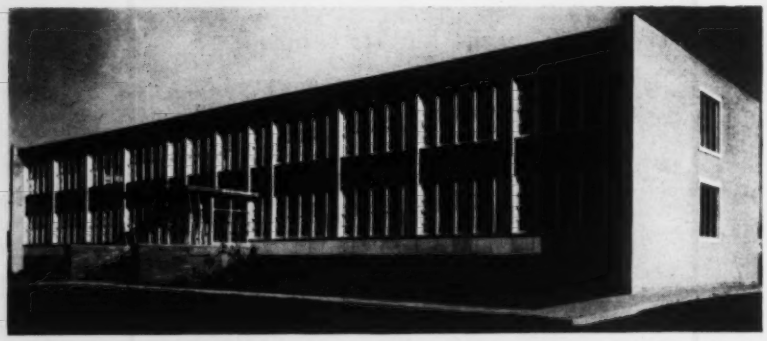
News of Engineers

(Continued from page 32)

G. C. McKinney, civil engineer, and **Park L. Verner,** land surveyor, announce the merger of their offices with the **Hunt Engineering Company** and **Lorell & Sicular,** consulting engineers, under the firm name McKinney Associates. Offices of the new firm will be at 2150 The Alameda, San Jose, Calif.

Wayne P. Wallace, former professor of civil engineering at Louisiana State University, has accepted appointment as head of the department of civil engineering at Southwestern Louisiana Institute.

Van Reuth and Weidner, Inc., civil engineers & surveyors, announce that their office is now located at 411 Tunbridge Road, Baltimore, Md.



Recently completed modern office building provides expanded space for the John W. Cowper Co., Inc., of Buffalo, N. Y. The company, which has constructed over $300 million of industrial and commercial buildings in the western New York area, was organized in 1915 by the late John W. Cowper, Director of ASCE from 1941 to 1943. Daniel S. Niederlander, M. ASCE, is president of the firm, and Fred O. Francis, M. ASCE, vice-president.

O. H. Storey Jr. has been appointed product manager for gypsum products of the Flintkote Company New York, N. Y. For the past seven years, Mr. Storey has been manager of technical services for the Gypsum Association. Prior to 1950, he was president and general manager of Steel & Roof Structures of St. Louis and Memphis.

Harvey J. Goetz, manager of Dorr-Oliver, Ltd. in India, with headquarters in Bombay, has been active in the field of public health for his firm, which is providing equipment for many large sewage and water treatment projects there. During a jaundice epidemic in New Delhi last year, Mr. Goetz worked with **Dr. B. V. Bhoota** in investigating its causes. As a result of their findings, equipment was furnished for the construction of a domestic sewage system, which is now in operation.

Alvin G. Viney, Brigadier General, commander of the 1st Logistical Command, Fort Bragg, N. C., has been named deputy chief of engineers for military operations, Washington, D. C. In his new assignment, General Viney succeeds **Maj. Gen. C. Rodney Smith** who has retired from the Army. Prior to his appointment as deputy chief of engineers, General Smith served as army member of the Department of Defense Advisory Committe on Professional and Technical Compensation.

DECEASED

Robert William Baily (M. '29), age 72, retired manager of the Baily Vibrator Company, Philadelphia, Pa., died recently. Earlier in his career, Mr. Baily was president and manager of the Baily-Davis Corporation of the same city. He was a graduate of the University of Wisconsin.

Paris Russell Burn, Sr. (M. '52), age 60, head of the Las Cruces (N. Mex.) firm bearing his name, died on July 28. Prior to the formation of the P. R. Burn Company, Mr. Burn was partner and general manager of Hayner and Burn, Engineers and Contractors. A graduate of the University of South Carolina, Mr. Burn was engaged in design and construction work throughout his career.

Harold P. Burrell (M. '43), age 74, New York district manager for the C. L. Guild Construction Company of Providence, R. I., died at his home in Darien, Conn., on September 1. Prior to his association with the firm, he was a special consultant for the Franki Foundation Company of New York. For 16 years he was chief engineer for the Western Foundation Company of New York. Mr. Burrell, well known in the construction industry in both the United States and Canada, designed the foundation for the Jefferson Memorial at Washington, D. C. He received his engineering degree from L'Ecole Polytechnique, in Zurich, Switzerland.

Glen C. Cook (A.M. '44), age 53, superintendent of the Ready Mixed Concrete Plant of the American Builders Supply Company, Louisville, Ky., died recently. Mr. Cook completed his undergraduate work at the University of Kentucky, receiving his B.S.C.E. degree in 1929 and his C.E. in 1943.

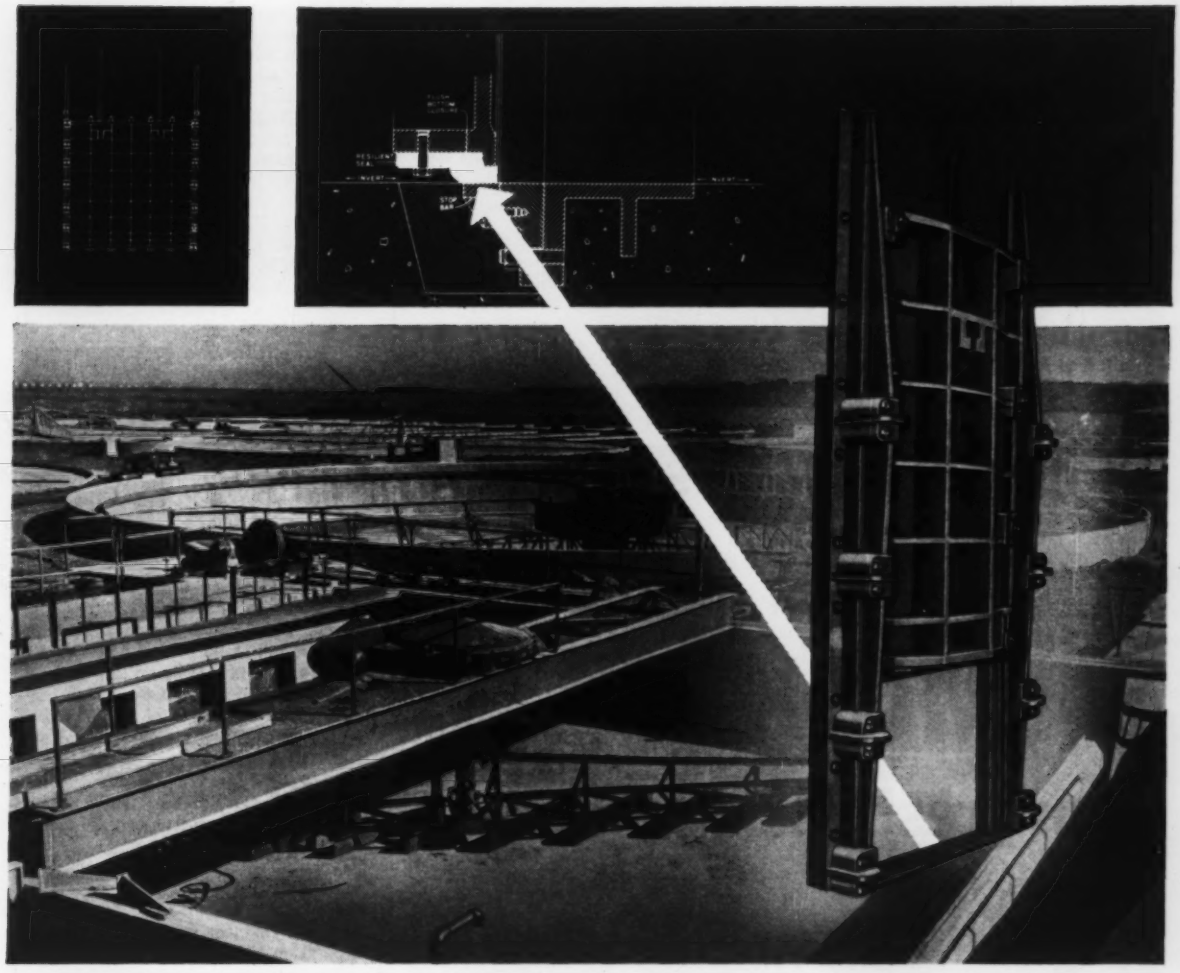
George R. Cooke (A.M. '08), age 77, president of the Cooke Contracting Company of Detroit, Mich., died recently. Mr. Cooke was educated at Massachusetts Institute of Technology, and had a long career in construction engineering.

Arthur M. Field (M. '39), age 66, chief engineer of the Charleston (S. C.) Development Board since 1945, died in a Charleston hospital on August 2. As the board's top engineer, Mr. Field was responsible for attracting a number of industries to the Charleston area. He conceived the idea of the Bushy Park industrial water project, which provides fresh water for Charleston industry. Mr. Field went to Charleston from Memphis, where he had been industrial engineer with the Memphis Chamber of Commerce. He was graduated from Cornell University in 1914.

Reamy Curtis Fitch (A.M. '39), age 54, head of Reamy C. Fitch and Associates, consulting engineers of Phoenix, Ariz., died on July 8. Mr. Fitch was widely known for his work in the water works and sewerage field, and at the time of his death, was engaged in developing a Sanitary Sewer System for Scottsdale, Ariz. At one time he was in the engineering division of the Arizona State Health Department. Early in his career, he was a mechanical engineer at the Phoenix Alcoa plant and consultant for the Reynolds Metals Company. Mr. Fitch was a graduate of Kansas University.

Neal Hanson (A.M. '17), age 73, construction engineer of Cimarron, N. Mex., died on July 29. Until his death, and for the past 37 years, Mr. Hanson had been a partner in the Solvangen Company of Cimarron. He was also engineer-in-charge of the Eagles Nest Irrigation Project and president of the Springer Ditch Company of Springer, N. Mex. Mr. Hanson was born and educated in Denmark. In his early career here he did railroad work.

(Continued on page 120)



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HY-Q sluice gates assure maximum clear opening and greatest possible flow; reduce turbulence to a minimum. Improved flow means substantial economies . . . smaller gate size, narrower channel and lower channel walls. Because HY-Q gates seat at the lowest level of the channel, there is maximum hydraulic gradient. 16 Rodney Hunt sluice gates are used in this modern sewage treatment plant — Beaumont, Texas — pictured above.

Rodney Hunt HY-Q Sluice Gates with flush bottom closure are designed to give water control engineers and contractors far greater design flexibility in dams, water filtration, sewage, power plants, flood and irrigation projects. For further information write for Catalog No. 75.

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RODNEY HUNT®

SERVING WATER CONTROL ENGINEERS WITH SLUICE GATES AND ENGINEERING

Deceased

(Continued from page 118)

George F. Harley (M. '42), age 81, retired construction engineer, died in Kerrville, Texas, on June 22. Prior to his retirement, Mr. Harley was with the Federal Works Agency at Fort Worth. For many years, he was superintendent of construction for Stone & Webster Engineers, working in Georgia, Illinois and Massachusetts.

Charles S. Hill (M. '50), age 52, bridge engineer for Michael Baker Inc., at Jackson, Miss., died on June 13. In 1934 Mr. Hill was appointed bridge engineer for the Mississippi State Highway Department; he was then the youngest state bridge engineer in the country. Mr. Hill remained with the state until 1951, when he became resident bridge engineer for Hazelet and Erdal. In 1950 Mr. Hill was honored by the American Institute of Steel Construction for his bridge design work. He was a graduate of Mississippi State College.

Chi Yeun Hou (M. '34), age 60, commissioner of the Department of Communications of the Taiwan Provincial Government, Taipeh, Formosa, died on August 19. Prior to his work in Formosa, Mr. Hou had been director of the Chekiang—Kiangsi Railway in Hangchow, China; director and chief engineer of the Human Kiveichow Railway in Siangtan; and associate managing director and associate engineer-in-chief for the Chekiang-Kiangsi Railway in Hangchow. Mr. Hou received a degree from Tangshan Engineering College, and an M.C.E. from Cornell University.

Irving V. A. Huie (M. '21), age 68, former ASCE Director and president of the New York City Board of Water Supply, died at his home in Douglaston (N. Y.) on August 30. An engineer whose special interests were bridge and subway construction, Mr. Huie had a long record of public service dating back to 1918 when he entered state employ as a second deputy highway commissioner. After a brief period in that capacity, Mr. Huie engaged in a private practice, and later became associated with the firm of Madigan and Hyland. Mr. Huie was appointed first chief engineer of the Department of Public Works in 1937 by Mayor La Guardia, and was later named commissioner of the department. In 1947 Mr. Huie accepted a lifetime post on the Board of Water Supply and was named president of that agency shortly thereafter.

I. V. A. Huie

Thomas M. Jasper (M. '22), age 74, consulting engineer for the A. O. Smith Corporation, Milwaukee, Wis., died at his home there on August 3. With the firm since 1926, Mr. Jasper was a research consultant at the time of his death. He was the author of many technical articles, and frequently lectured before engineering groups. Early in his career, he taught at the University of Wisconsin and at the University of Illinois, from which he received his engineering degrees.

Ibrahim Dahoud Khalaf (J.M. '54), age 27, died recently in an accident in Amman, Jordan, where he made his home. Mr. Khalaf was graduated from Michigan State College in 1954. While in this country, he was an engineer in the Ann Arbor (Mich.) Department of Public Works.

James L. Lytel (M. '17), age 85, retired civil engineer, died at his home in Chula Vista, Calif., on August 16. Prior to his retirement, Mr. Lytel was project engineer on the Lower Rio Grand Flood Control Project, with headquarters in San Benito, Tex. Earlier he served as manager of Dwight P. Robinson & Co., De La Argentina, and as superintendent for the U. S. Reclamation Service at Yakima, Wash.

(Continued on page 122)

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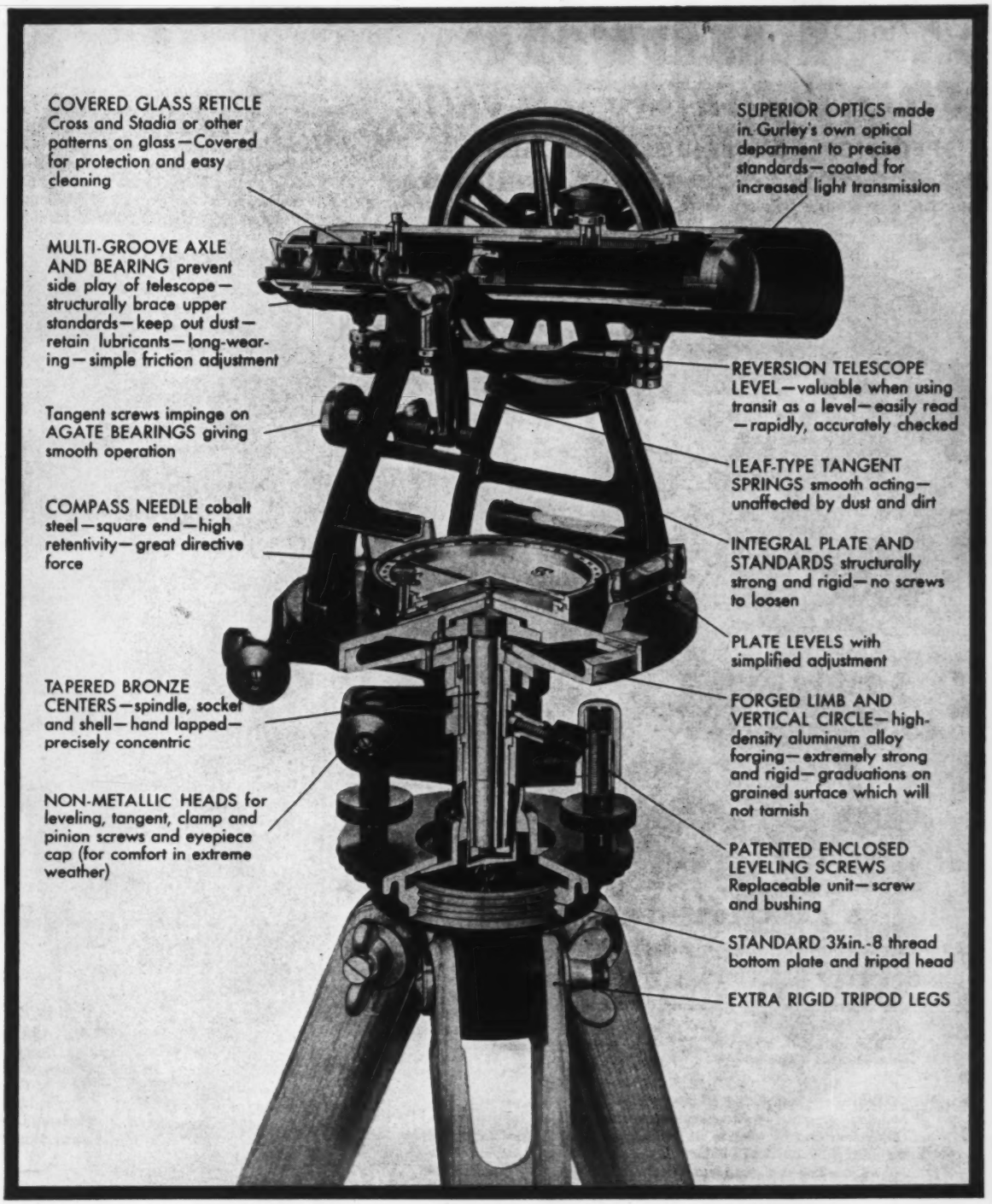
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MULTI-GROOVE AXLE AND BEARING prevent side play of telescope—structurally brace upper standards—keep out dust—retain lubricants—long-wearing—simple friction adjustment
Tangent screws impinge on AGATE BEARINGS giving smooth operation
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REVERSION TELESCOPE LEVEL—valuable when using transit as a level—easily read—rapidly, accurately checked
LEAF-TYPE TANGENT SPRINGS smooth acting—unaffected by dust and dirt
INTEGRAL PLATE AND STANDARDS structurally strong and rigid—no screws to loosen
PLATE LEVELS with simplified adjustment
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PATENTED ENCLOSED LEVELING SCREWS Replaceable unit—screw and bushing
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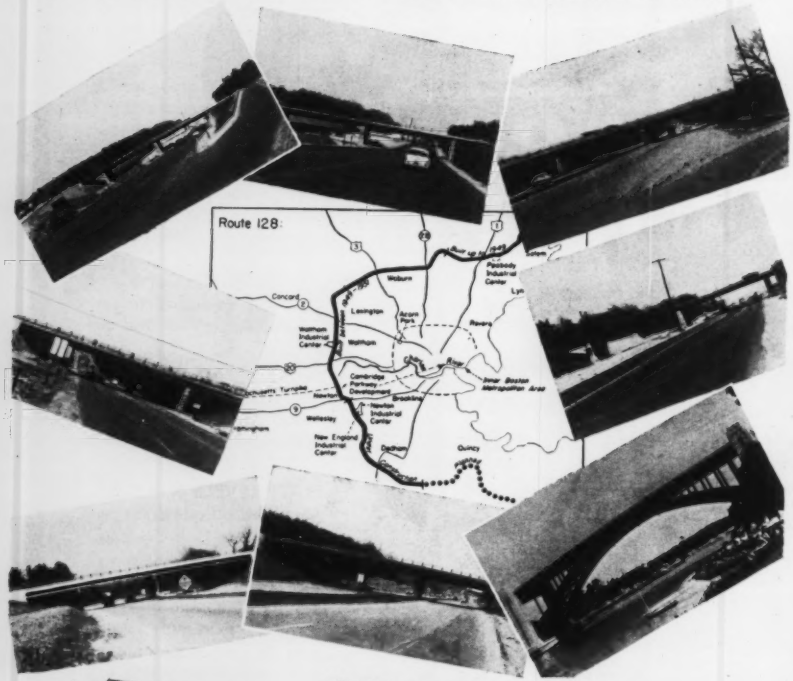
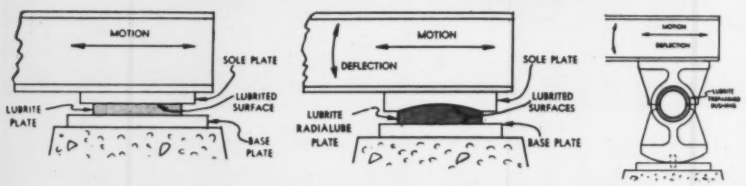


3 BASIC LUBRITE ASSEMBLIES



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Deceased

(Continued from page 120)

John Parsons Newton (A.M. '10), age 78, senior civil engineer with the New York State Department of Public Works, died recently at his home at Selkirk, N. Y. Mr. Newton had served the state since 1905, first as engineer on construction of the Barge Canal at Fort Miller, and later in the Bureau of Hydraulics. Through the years, Mr. Newton's principal activity was in connection with hydraulic problems coming before the State Department of Public Works. On many occasions, he was loaned to other states as a consultant. Mr. Newton was a graduate of Rensselaer Polytechnic Institute.

Harry G. Porter (A.M. '12), age 80, retired civil engineer, died recently at his home in Yonkers, N. Y. For some years, Mr. Porter was an assistant engineer with Hazen, Whipple and Fuller of New York City. He retired in 1933. Mr. Porter was a graduate of Dartmouth College.

James B. Reill (A.M. '40), age 53, design engineer for the Belmont Iron Works, Philadelphia, Pa., died on July 3. Before his association with the company, Mr. Reill had been assistant naval structural architect for the U.S. Navy at the Philadelphia Navy Yard, and had served Bethlehem Steel as structural designer in the fabricated steel department.

Marion Drake Ross (M. '31), age 73, engineer and executive secretary of the Plantmix Asphalt Industry of Kentucky, Inc., died in Frankfort, Ky., on August 17. Prior to his association with the firm, Mr. Ross had served as district engineer for the State Highway Department, a position he had held for twenty years. He had also worked as engineer-salesman for the Pollack Steel Company of Cincinnati, Ohio.

William T. Savage, Jr., (J.M. '48), age 32, a civil engineer with Albright and Friel, Inc., of Philadelphia, Pa., died there on August 25. Mr. Savage was a graduate of the Drexel Institute of Technology and received his master's degree from the University of Pennsylvania. He lived at 1221 E. Cheltenham Avenue, Philadelphia.

Clifford Shoemaker (M. '22), age 73, retired division engineer for the U.S. Bureau of Public Roads at Kansas City, Mo., died recently. Mr. Shoemaker served the Bureau of Public Roads in various capacities and sections of the country from 1918 until his retirement. He received his C.E. from Ohio State University and an LL.B. from the College of Law in Washington, D. C.

(Continued on page 126)

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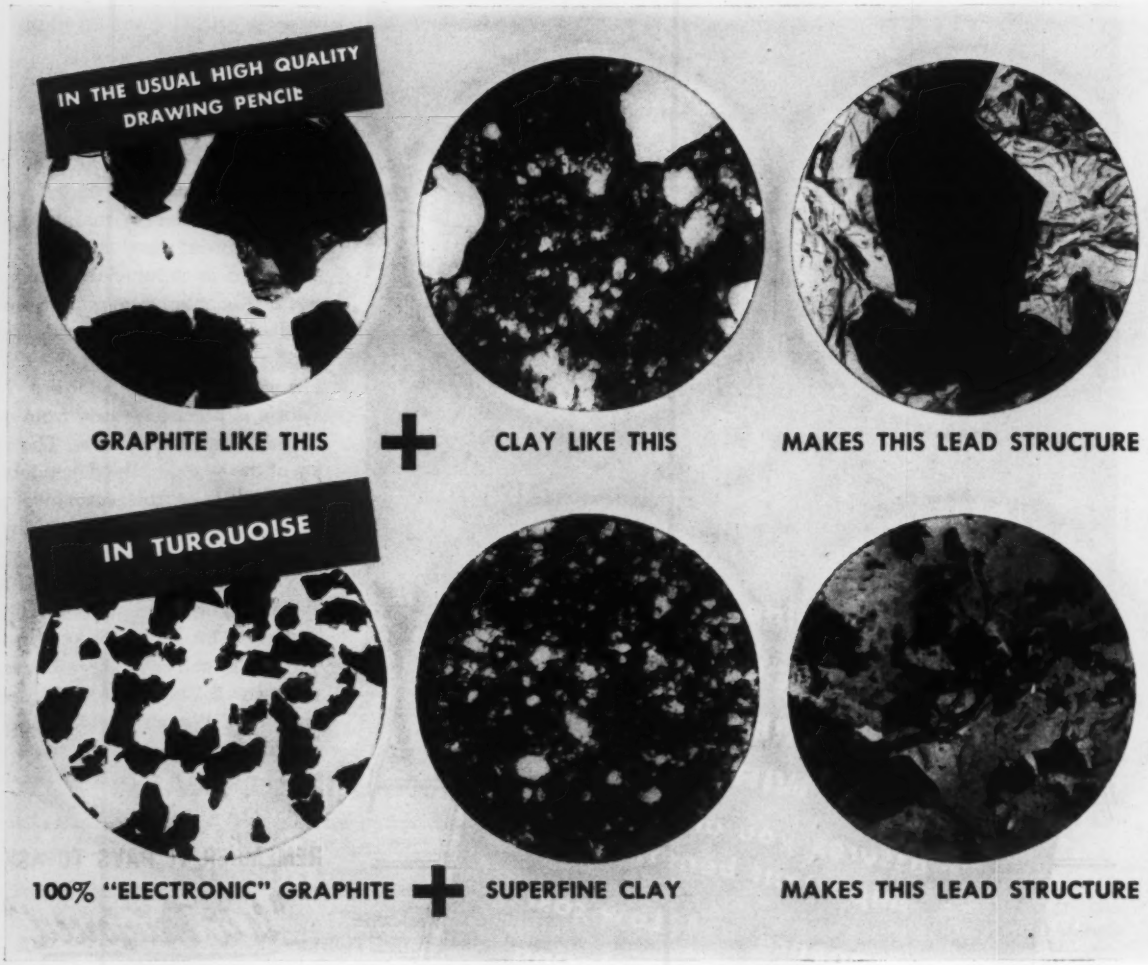

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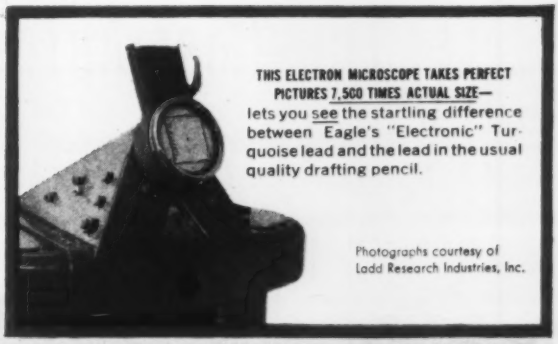
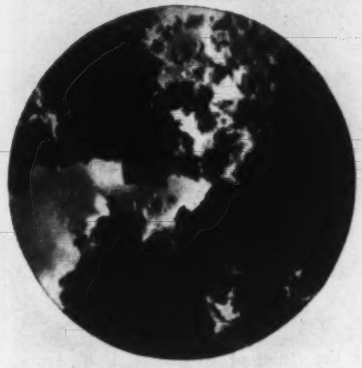


THIS ELECTRON MICROSCOPE TAKES PERFECT PICTURES 7,500 TIMES ACTUAL SIZE— lets you see the startling difference between Eagle's "Electronic" Turquoise lead and the lead in the usual quality drafting pencil.

Photographs courtesy of Ladd Research Industries, Inc.



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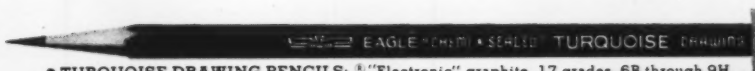

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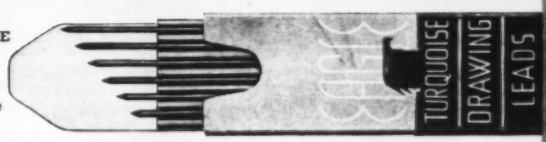

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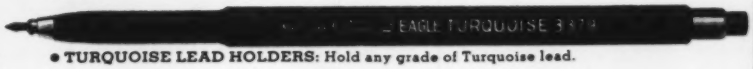

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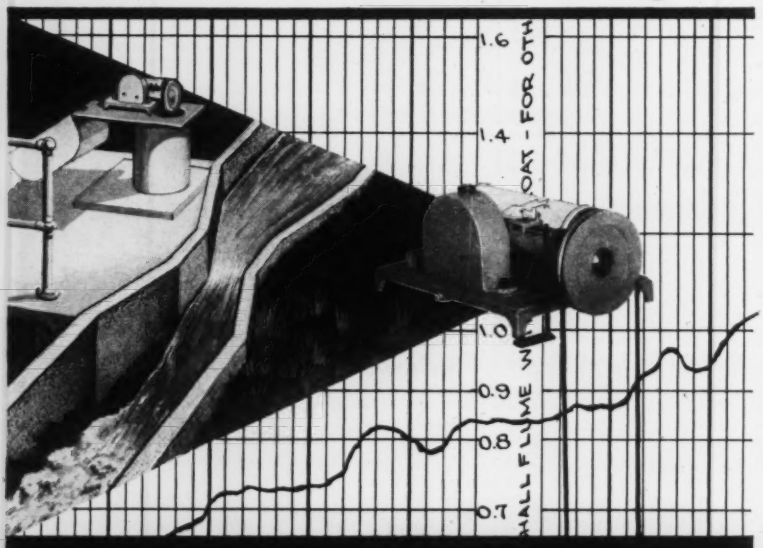

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Deceased

(Continued from page 122)

Perry Thomas Simons (M. '21), age 79, retired assistant engineer for the Missouri Pacific Railroad, St. Louis, Mo., died on June 27. Early in his career Mr. Simons was with the Chicago, Peoria and St. Louis Railroad at Edwardsville, Ill., and the Missouri Pacific Railroad. After a ten-year interval, which he spent as engineer on drainage and flood control with the U.S. Department of Agriculture, Mr. Simons returned to the Missouri Pacific Railroad as assistant engineer. He was a graduate of Purdue University.

Raghbir Sardar Singh (M. '49), age 63, retired civil engineer, died recently at his home in New Delhi, India. Prior to his retirement Mr. Singh was secretary and chief engineer for the Public Works Department of Patiala and the East Punjab States Union.

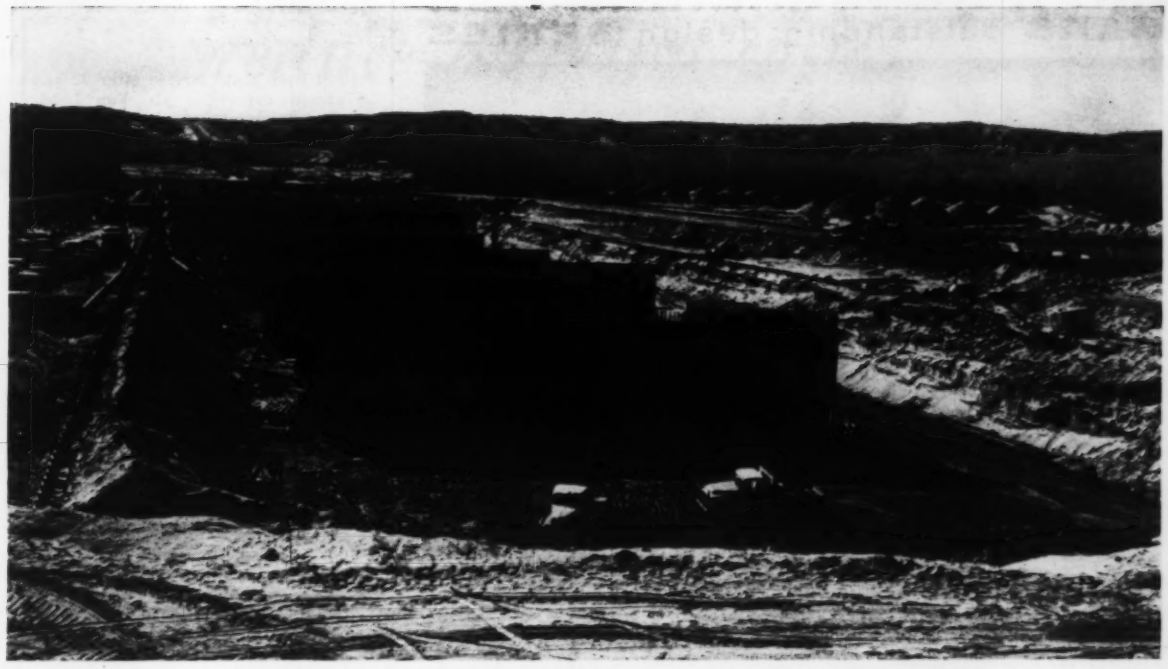
Arthur R. Smith (M. '35), age 66, former chief of the construction equipment section of the Engineering Research and Development Division, Office of the Chief of Engineers, U.S. Army, Washington, D. C., died recently. His home was at Hamden, Conn. Mr. Smith had been assistant engineer for the Indiana State Highway Commission and development engineer for the Moulding-Brownell Corp. of Chicago. He had a Ph.D. from the Sheffield Scientific School at Yale University.

Charles Underhill Stepath (M. '23), age 80, retired assistant city engineer of Springfield, Mass., died on May 24 at his home in Van Wert, Ohio. Mr. Stepath had been a general consultant, civil engineer for the Fred T. Ley Company of Springfield, and advisory engineer for the Portland Cement Association, also in Springfield. Mr. Stepath completed his undergraduate and graduate work at Manhattan College.

Philip F. Stephens (A.M. '16), age 75, retired engineer for the Monroe County (N. Y.) Division of Regional Planning and the Geodetic Local Control Survey, died on August 31. Earlier in his career, Mr. Stephens had served the Monroe County Department of Public Works, and had worked for the Rochester Gas & Electric Corp., the Stone & Webster Engineering Corp., of Boston, and the W. S. Bastow Company. He was a former president of the Rochester Section. Mr. Stephens was a graduate of Rensselaer Polytechnic Institute.

William James Van London (M. '53), age 64, president and manager of the Vlando Mining Company of Houston, Texas, died recently in an auto accident in Utah. In 1955 Mr. Van London

(Continued on page 128)



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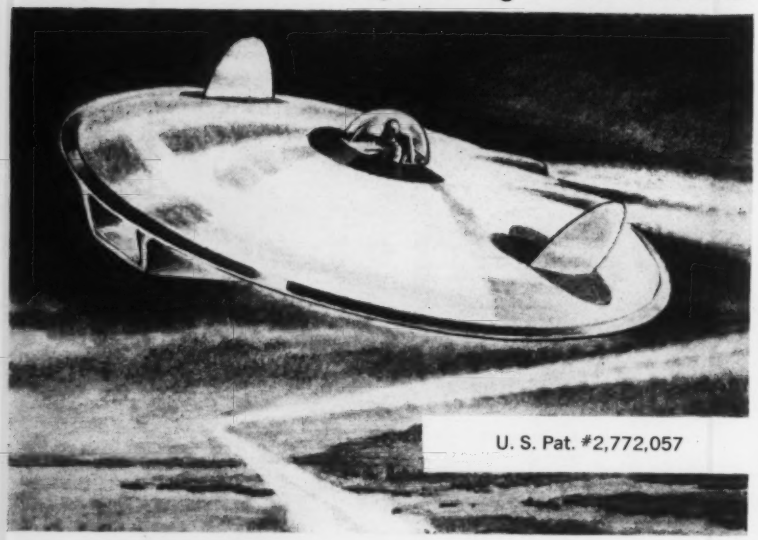

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Mars has long been the standard of professionals. To the famous line of Mars-Technico push-button holders and leads, Mars-Lumograph pencils, and Tradition-Aquarell painting pencils, have recently been added these new products: the Mars Pocket-Technico for field use; the efficient Mars lead sharpener and "Draftsman's" Pencil Sharpener with the adjustable point-length feature; and—last but not least—the Mars-Lumochrom, the new colored *drafting* pencil which offers revolutionary drafting advantages. The fact that it blueprints perfectly is just one of its many important features.

The 2886 Mars-Lumograph drawing pencil, 19 degrees, EXEXB to 9H. The 1001 Mars-Technico push-button lead holder. 1904 Mars-Lumograph imported leads, 18 degrees, EXB to 9H. Mars-Lumochrom colored *drafting* pencil, 24 colors.

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at all good engineering and drawing material suppliers

Deceased

(Continued from page 126)

retired from state service after 32 years in various capacities. Mr. Van London was engineer-manager of the Texas Highway Department and is credited with the planning and design of the network of freeways for metropolitan Houston.

Harry B. Walker (M. '21), age 73, professor emeritus of the University of California, died at his home in Davis, Calif., on July 27. Dr. Walker was on the University of California staff from 1928 to 1951, and chairman of the department of agricultural engineering for nineteen of those years. Prior to his work there, Dr. Walker served Kansas State College, first as extension engineer in irrigation and drainage, and later as chairman of the department of agricultural engineering. Dr. Walker was the author of a number of technical articles.

Positions Announced

The City of San Diego. Announcement is made of an opening for an Urban Renewal Coordinator. The salary range is $713 to $866 a month. Applicants must be U. S. citizens, between the ages of 21 and 52. They must possess experience and training equivalent to graduation from college with major work in urban planning, public administration, civil engineering or a related field, and five years of experience in urban planning, renewal programs or general public administration (at least three of them in a responsible administrative capacity). Each applicant must submit an official application blank and resumé of his training and experience (2,000-word maximum) to City Service, Room 453 Civic Center, San Diego 1, Calif.

U.S. Coast Guard. The 83rd District has vacancies for three Civil Engineers with headquarters in New York City. Civil Engineer, GS-12, for work as a supervisory engineer responsible for assisting in the over-all administration of the civil engineering program for the Coast Guard in this area. The salary range is $7,570—$9,290 per annum. Two Civil Engineers, GS-11, for designing construction work and maintenance planning of existing Coast Guard shore facilities. The salary range is $7,035—$8,180 per annum. Information from the Civilian Personnel Section, Room 624, Customhouse, New York, N. Y.

Washington State Health Department. There are openings for three Public Health Engineers, and one senior Public Health Engineer. Applications for Public Health Engineer will be accepted from persons with a bachelor's degree in civil engineering and at least one year of professional engineering experience to start as engineer-in-training. The salary range is $451—$537 per month. A Senior Public Health Engineer is wanted to conduct engineering and sanitation field surveys and investigations and assist the head of the Sanitary Engineering Section in planning, promoting and supervising sanitary engineering programs. Applicants must have been graduated from an accredited four-year college with a major in chemical, civil or sanitary engineering, and must have one year of graduate study in civil, sanitary or public health engineering and three years of engineering experience including two years of public health or sanitary engineering. No examination is required. Until further notice applications will be accepted by the Washington State Personnel Board, Headquarters at 212 General Administration Building, Olympia, Wash., or Branch Office, 317 Smith Tower, Seattle 4, Wash.

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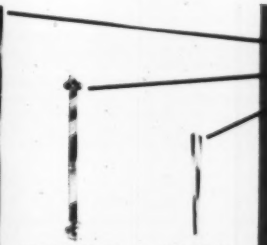

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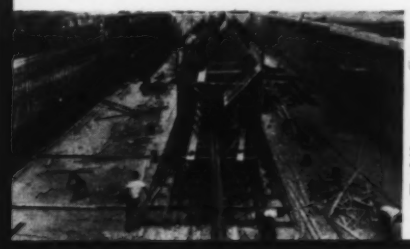

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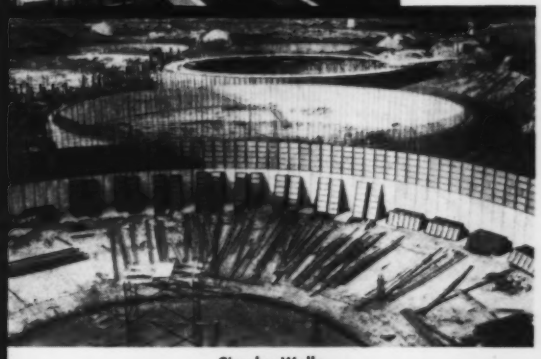

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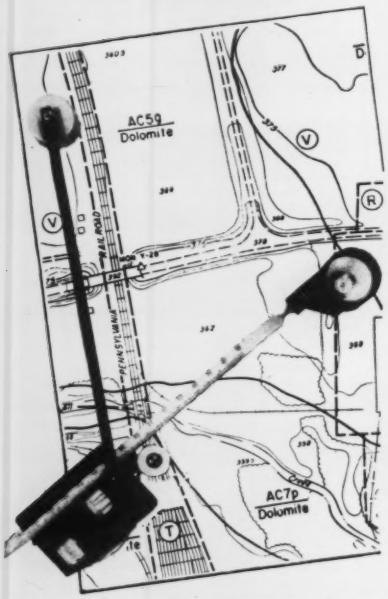

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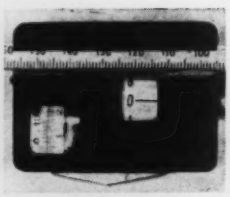

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New Publications

Underground corrosion . . . A final report on the studies of underground corrosion conducted by the National Bureau of Standards over a 45-year period has been released. Results of the field and laboratory investigations of this serious engineering and economic problem are presented in the 227-page illustrated publication. Copies, priced at $3.00 each, may be ordered from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Waterways Experiment Station . . . Issuance of four new publications detailing recent hydraulics and soil compaction investigations of the Corps of Engineers is announced by the Waterways Experiment Station. The new Technical Memoranda are identified as No. 2-337, which describes a Delaware River model study, hydraulic and salinity verification; No. 2-428, dealing with entrances to conduits of rectangular cross-section; No. 2-429, reporting a model investigation of hydraulic capacity of meandering channels in straight floodways; and No. 3-271, which reports the compaction effect of tire pressure and number of coverages of rubber-tired rollers and foot-contact pressure of sheepsfoot rollers. All sell for $1.00 except for No. 3-271, which is 75 cents. Checks should be made payable to the Treasurer of the United States and sent to the Director of the Waterways Experiment Station, P.O. Box 631, Vicksburg, Miss.

Winter concreting . . . Publication of a revised American Concrete Institute Standard, "Recommended Practice for Winter Concreting," is announced by the American Concrete Institute. The standard incorporates several changes from the last editions. Air-entrained concrete and addition of 1 percent of calcium chloride are recommended for use in cold weather, as they permit a reduction in the time newly placed concrete must be protected. The standard covers the use of accelerators and anti-freezes; heating of materials; preparation of subgrade; protective coverings and enclosures; curing; and form removal. Copies are 75 cents each (50 cents to ACI members), and may be obtained from the American Concrete Institute, 18263 West McNichols Road, Detroit 19, Mich.

Timber design . . . To save engineers, architects, and builders many of the time-consuming operations previously necessary in designing structural wood members, the National Lumber Manufacturers Association has issued a revised edition of "Wood Structural Design Data." The new edition includes 362 pages of design information and safe load tables for wood beams, columns, plank and laminated floors and roof decks, and stud walls. It is designed for use with local building codes or the National Design Specification for Stress-Grade Lumber and Its Fastenings, another of the association's standard publications. Both publications are available from the National Lumber Manufacturers Association, 1319 18th Street, N.W., Washington 6, D. C. The revised volume is $4.00 a copy, and the specification 50 cents.

Water supply and sanitation . . . Problems of water supply and sanitation encountered at advanced military bases are discussed by military and civilian experts in a 418-page Navy volume available to industry through the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Interest is primarily focused on the standardization of equipment components, the coagulation problem in pretreatment of water, sewage disposal in Arctic regions, and the serious difficulties caused by sealing in distillation equipment. The book sells for $7.00.

Airport financing . . . Free copies of Research Report No. 24 of the University of California Institute of Transportation and Traffic Engineering (Berkeley 4, Calif.) are available upon application to the Institute. Richard Zettel and Robert Horonjeff, A.M. ASCE, are authors of the 60-page publication, which is entitled "The Practice and Theory of Airport Financing Based on a Survey of California Airports."

Employee appraisal . . . "What the Supervisor Should Know and Do" is the title of a 16-page leaflet devoted to employee appraisal. Waldo E. Fisher, professor of industrial relations at the Wharton School of Finance and Commerce, is the author. The bulletin, which is identified as Number 27, may be ordered from the Bookstore, California Institute of Technology, Pasadena, Calif. The price is $1.00.

Air pollution . . . The urgent problem of air pollution has prompted a good deal of thought and study on both local and federal levels. Four new bulletins on the subject have just been made available. "Air Pollution in Connecticut" is a joint report by the Connecticut Department of Health and the U. S. Department of Health, Education and Welfare. Copies may be obtained without charge from the Community Air Pollution Program, Robert A. Taft Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio. The Proceedings of the Cleaner Air for Urban Areas Symposium are now offered by the Franklin Institute (Philadelphia 3, Pa.) at $3.00 each. The results of a "Study of Atmospheric Emissions from Oil Refineries" have just been released by the Los Angeles Air Pollution Control District. A limited number of copies is available from Carl V. Kanter, Los Angeles County Air Pollution Control District, 434 South San Pedro Street, Los Angeles 13, Calif. In summation of the work being done on air pollution, the U. S. Department of Health, Education and Welfare and the Air Pollution Control Association have published a "Directory of Governmental Air Pollution Agencies". For information write Robert A. Taft Sanitary Engineering Center, or the Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh 13, Pa.

Concrete masonry units . . . "Effects of Variations in Curing and Drying on the Physical Properties of Concrete Masonry Units" is a new report of the Portland Cement Association. The authors, W. H. Kuenning and C. C. Carlson, present the results of a comprehensive program of tests. Inquiries should be addressed to the Portland Cement Association, 33 West Grand Avenue, Chicago 10, Ill.

Nail research . . . E. George Stern, research professor at Virginia Polytechnic Institute, has added two new pamphlets to his growing list of publications in the field of nail research: "Wood, Plywood or Steel Gusset Plates for Nailed Trussed Rafters" and "Holding Power of Large Nails and Spikes in Dry Southern Pine". Information from Professor Stern at Virginia Polytechnic Institute, Wood Research Laboratory, Blackburg, Va.

Atomic energy . . . The Johns Hopkins Press has announced the publication of "Atomic Energy Applications with Reference to Underdeveloped Countries". The timely 144-page book presents a compact, practical body of information indicating the range of technological possibilities and economic, social and technical problems in the use of atomic energy. The authors of the survey are Bruce C. Netschert and Sam H. Schurr, both members of the staff of Resources for the Future, Inc. Copies at $2.00 each are available from the Johns Hopkins Press, Baltimore 18, Md.

Beach erosion . . . The Beach Erosion Board of the Corps of Engineers has issued three reports on beach and wave research: "Sand Bypassing at Port Hueneme, Calif.", Technical Memorandum No. 92; "Changes in Configuration of Point Reyes Beach, Calif., 1955-1956", Technical Memorandum No. 91; and "Modification of the Quadratic Bottom-Stress Law for Turbulent Channel Flow in the Presence of Surface Wind Stress", Technical Memorandum No. 93. Inquiries should be addressed to the Beach Erosion Board, Office of the Chief of Engineers, Corps of Engineers, Washington 25, D. C.

Water supply . . . To aid public officials and private citizens who must make imminent decisions on water, sewage and draining systems, the National Sanitation Foundation has submitted "A Report on the Water Supply for the Six County Area of Southeastern Michigan". Interested persons should write the publishers at the School of Public Health, University of Michigan, Ann Arbor, Mich.

(Continued on page 134)

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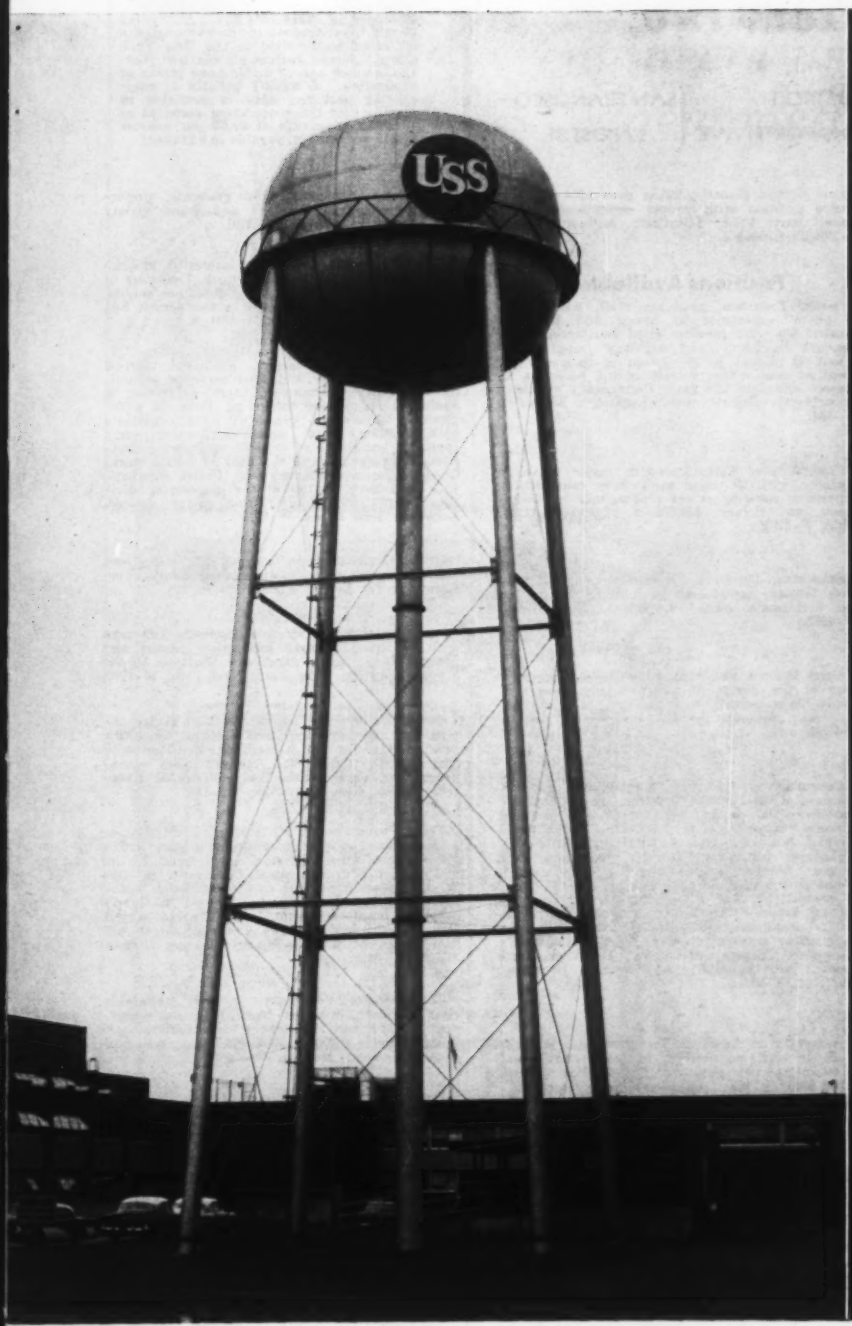

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Men Available

CONSTRUCTION SUPERVISOR FOR ARCHITECTS AND ENGINEERS OR PROJECT MANAGER, M. ASCE; registered New Hampshire, Ph.B.; 59; Contractor on all types of heavy airports, 34 years' experience. Location desired: open. C-249.

SOILS ENGINEER, A.M. ASCE; M.S. Soils, B.S.C.E.; 33; 8 years' in structural design and foundations, soils work, lab and field testing, supervision, etc., power plants, airfields, roads and earth dams. Location: anywhere; preferably overseas. C-250.

CIVIL ENGINEER, M. ASCE; B.S. & M.S. in C.E.; 47; Over 20 years' progressive responsible experience in design and construction of dams, tunnels, canals, and power plants. Desire responsible position with real opportunities. Location desired: open. C-253-403-San Francisco.

RECENT GRADUATE, J.M. ASCE; B.S.C.E.; 24; Estimator—summer work; Military technical advisor and writer with Construction Division, U.S. Navy Publications Training Center—1 year; Testing model bridges—part time for 2 years'. Location desired: anywhere in United States, C-251.

STRUCTURAL ENGINEER, J.M. ASCE; 32; B.C.E.; registered P.E. Pennsylvania and New Jersey; 8 years' diversified experience in structural design, post-graduate work in prestressed concrete. Interested in employment in prestressed concrete field in design or sales. Location desired: middle Atlantic. C-255.

EXECUTIVE ENGINEER AND CONSTRUCTION ADMINISTRATOR, M. ASCE; C.E.; P.E. New York; 14 years' experience heavy construction management, supervision and engineering also industrial sales, both foreign and U. S. Seeks challenging permanent position. Fluent Spanish. Available Venezuela for right offer September 15. Location: Preferably South America. C-254.

STAFF PROJECT ENGINEER, J.M. ASCE; P.E. in New York, Pennsylvania and Washington; M.S. in C.E.; 30; experienced in directing engineering of all phases of heavy industry projects to completion, in estimates for contractor and proposals for consultant, contacts for clients. Location: East or West. C-256.

CIVIL ENGINEER, A.M. ASCE; M.S., Columbia University; 34; 7 years' experience in structural design and hydraulics; dam site investigations, surveying, plant construction. Licensed P.E. Location desired: anywhere in U. S. C-257-Detroit.

DESIGN OR CONSTRUCTION ENGINEER, J.M. ASCE; B.S.C.E.; 29; 4 years' experience with highway department in various capacities. 1½ years' as squad leader. 2 years' commissioned officer in Corps of Engineers. Project Engineer in road construction. Location desired: Europe or Middle East. C-258-829-Chicago.

SUPERVISORY CIVIL ENGINEER, B.S.C.E.; 34; A.M. ASCE; P.E.; Owners representative for 7 years in responsible charge of construction of steam electric plants totaling over $200 million. Desire position with proper opportunity. Will travel part time. Location: Middle States. C-259-828-Chicago.

Positions Available

OFFICE ENGINEER, graduate civil, with 5 to 10 years' experience in heavy and highway construction; for medium sized contracting firm engaged in heavy and highway construction. About 80 percent to 90 percent of time will be spent at main office; remainder will be spent at project offices in the field. Permanent; excellent opportunity. Salary open. Location: Midwest. W-5203.

CONSTRUCTION SUPERINTENDENT, under 55, civil engineer, with 10 years' supervisory construction experience covering power plants, mill buildings, roads, etc. Salary, $10,000 a year. Location: Cuba. F-5262(a).

STRUCTURAL DESIGNER, DRAFTSMAN AND SPECIFICATION WRITER, experienced in building design for an architect's office. Location: Connecticut. W-5267.

CIVIL PROJECT ENGINEER, with 10 years' experience in the design of water supply, sewerage, roads, flood control, to represent American firm in Iran. Several years' work. Salary open. F-5263.

CONSTRUCTION ENGINEER, Mechanical, graduate mechanical, 35-45, with a minimum of 10 years' experience in design and supervision of mechanical installations for industrial and commercial buildings and hospitals, including installations for water services; plumbing and sewers; heating, ventilating; air conditioning; steam generating and distribution; etc. Will act as consultant and adviser to foreign governmental agencies and foreign private enterprises. Salary commensurate with past earnings and experience; transportation expenses and quarters allowance. Climate sub-tropical. Duration eleven months with possibility of extension. Location: Far East. F-5271.

ASSISTANT OR ASSOCIATE PROFESSOR with at least M.S. in civil engineering, to teach: (*a*) Fluid Mechanics; (*b*) Sanitary Engineering. Salary, $6000-$7000 a year. Location: New Jersey. W-5284.

SOILS ENGINEER, B.S. degree, for rolled earth dam—4 million cubic meters. Will supervise ten to fifteen Turkish engineers and inspectors. Must have had at least 10 years' experience in soil mechanics including experience on inspection of earth dams. Prior experience in installation embankments and piezometer equipment. Prefer single status but applicant may take wife and small family. Salary, $10,800 a year, plus allowance. Location: Turkey. F-5396.

PROJECT ENGINEER, Civil Design, civil graduate, 35, with recent design experience plus good background in preparing and supervising others in preparing layouts, plans, details and specifications of streets, drainage, water, sewers and sewage systems on large industrial, commercial or public jobs for a large architectural-engineering firm. Should be qualified to advance to Chief of 10 to 30-man section. Salary, about $9600 a year to start. Employer pays placement fee. Location: Los Angeles, California. S-3090.

STRUCTURAL ENGINEER, civil graduate, preferably with highway bridge experience. Salary open. Location: Arizona. W-5293.

CIVIL ENGINEERS, graduates, interested in pursuing careers in public health work. One year of experience desired. Salary, $5412-$6444 per annum, with excellent opportunity for advancement. Location: Pacific Northwest. W-5311-S.

PRINCIPAL CIVIL ENGINEER, graduate, licensed professional engineer and land surveyor or ability to qualify for same. 8 years' experience in municipal engineering, including three in a responsible supervisory capacity; some experience with building codes, zoning ordinances, etc.; thorough knowledge of modern engineering practices and procedures in the field of public works maintenance and construction. Under direction, will supervise activities of the engineering division. Apply by letter stating salary desired. Location: New Jersey. W-5312.

CIVIL ENGINEER with considerable waterfront and harbor construction experience. Salary open. Location: Far East. F-5324.

SENIOR STRUCTURAL OR ARCHITECTURAL DESIGNER with at least 10 years' industrial, process and power plant design experience. Salary, $10,800 a year. Location: New York, New York. W-5329.

STRUCTURAL AND CIVIL ENGINEER with bridge design and highway experience. General consulting practice. Can lead to associate status. Man with well-rounded ability and interest takes precedence over highly specialized individual. Location: central New Hampshire. W-5338.

FIELD PROMOTIONAL ENGINEER, graduate civil or architectural, with little or no experience and a knowledge of structural steel construction. Duties will consist of promotional field work in uses of steel. Should be able to discuss design problems encountered in structural steel; be interested in promotional work and present subject well. Salary, $6000-$7500 a year. Employer will pay placement fee. Location: Chicago, Illinois. W-5343-C-6429.

CONSTRUCTION SUPERINTENDENT, 35-50, preferably civil graduate, with at least 10 years' supervisory experience in heavy construction and building fields. Salary, $8000-$10,000 a year, plus bonus. Location: Hawaii. F-5356-S.

INSTRUCTOR, B.S. or M.S. in civil engineering, with opportunity for research and advanced degree; courses to be taught depending on interests of applicant. Salaries: B.S., $42000-$5000; M.S., $4500-$5000. Location: Pennsylvania. W-5358(a).

ASSISTANT PROFESSOR in Civil Engineering, for courses in mechanics and structures. Opportunity for research and summer work. Also opening for an instructor. Location: New England. W-5383.

ASSOCIATE CIVIL ENGINEER, graduate, from 23, with 2 years' of progressively responsible engineering office experience, for work in the engineering division of a department of public works. Under direction, will be in charge of division of office engineering and of sewage treatment plants; plan, assign and direct work of engineering office staff involved in preparation of design, plans, cost estimates for maintenance and construction of streets, drains and sewage collection systems, etc. Salary, $6708 a year to start. Must be United States citizen. Location: California. W-5390-S.

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New Publications

(Continued from page 130)

Sanitation . . . The Public Health Service's Division of Sanitary Engineering Services announces the availability of a new publication, "Manual of Septic Tank Practice." Copies of the 85-page, illustrated brochure may be obtained from the Superintendent of Documents, Washington, D. C., for 35 cents each.

Urban planning and development . . . Successful shopping center operators are planning to meet the demands of future growth, according to a detailed analysis of 163 centers recently completed by the Urban Land Institute. Copies of the 166-page report, Technical Bulletin No. 30-Part II, may be purchased for $5.00 from the Urban Land Institute, 1200-18th Street, N.W., Washington 6, D. C.

Tidal hydraulics . . . The nature of variations in tides and tidal currents is explored by Brig. Gen. G. B. Pillsbury in a revised edition of "Tidal Hydraulics." Copies may be obtained from the U. S. Army Engineer Waterways Experiment Station, Vicksburg, Miss. The price is $2.50 a copy.

Water cooled reactors . . . Availability of a new "Corrosion and Wear Handbook for Water Cooled Reactors" is announced by the Atomic Energy Commission. The 293-page illustrated handbook, edited by J. D. DePaul, gives solutions to engineering problems resulting from the use of water as a heat-transfer medium in a reactor plant. Orders should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. The price is $2.25.

Radioactive effects on sludge digestion . . . A timely research work dealing with the effect of radioactive materials on the anaerobic decomposition of sewage sludges has been released as Bulletin No. 441 of the University of Illinois Engineering Experiment Station. The bulletin sells for 80 cents and may be obtained from the Engineering Experiment Station, University of Illinois, Urbana, Ill.

Welding handbook . . . A combination textbook and reference work on welding has been made available by the American Welding Society with issuance of the first section of the fourth edition of its "Welding Handbook". The 560-page book is available from the American Welding Society, 33 West 39th Street, New York 18, N. Y., at $9.00 per volume.

Nuclear technology . . . A 233-page illustrated book, entitled "Experimental Boiling Water Reactor", has just been released by the Atomic Energy Commission. The handy reference, written by the scientists and engineers who designed and built the reactor at the Argonne National Laboratory, sums up engineering data on this nuclear power plant, the first to go into continuous operation under the AEC's experimental power reactor program. Copies at $2.25 each may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Concrete standards . . . The 1957 edition of the "American Concrete Institute Book of Standards" has just been released. The 300-page book represents the most recent compilation of current ACI standards, specifications and recommended practices. Copies priced at $4.00 each, may be purchased from the ACI, P. O. Box 4754, Redford Station, Detroit 19, Mich.

Non-ASCE Meetings

American Concrete Institute. Tenth Regional Meeting at the Benjamin Franklin Hotel, Seattle, Wash., November 5 and 6. Further information from the American Concrete Institute, P. O. Box 4754, Redford Station, Detroit 19, Mich.

American Geophysical Union. Annual Pacific Northwest Meeting in conjunction with the Hydraulics Conference on the campus of the State College of Washington, October 28-31. For information write E. Roy Tinney, Chairman, Hydraulics Conference Planning Committee, Washington State Institute of Technology, Division of Industrial Research, Pullman, Wash.

American Nuclear Society. Second Annual Meeting and International Atom Week at the Coliseum, New York City, N. Y., October 28-November 1. For details write the Atomic Industrial Forum, 3 East 54th Street, New York 22, N. Y.

American Society for Metals. Second World Metallurgical Conference in conjunction with the 39th Annual National Metal Exposition and Congress, Chicago, Ill., November 2-8. Inquiries may be addressed to W. H. Eisenman, 7301 Euclid Avenue, Cleveland 3, Ohio.

Council on Wave Research. Sixth Conference on Coastal Engineering at the College of Engineering, University of Florida, Gainesville, Fla., December 2-7. For information write the Council on Wave Research, Engineering Field Station, University of California, Richmond 4, Calif.

Engineers General Assembly. Conference of the Engineers Joint Council and the Engineers' Council for Professional Development at the Statler Hotel, New York City, N. Y., October 24 and 25. Information from Dr. J. W. Barker, President, Engineers Joint Council or from M. D. Hooven, President, Engineers' Council for Professional Development, both located at 29 West 39th Street, New York 18, N. Y.

National Council of State Boards of Engineering Examiners. Thirty-sixth Annual Meeting at the Biltmore Hotel, Atlanta, Ga., October 31-November 2. Information from the NCSBEE, P. O. Drawer 1404, Columbia, S. C.

National Safety Council. Forty-fifth Annual National Safety Congress and Exposition at the Conrad Hilton, Congress, Morrison, and La Salle Hotels, Chicago, Ill., October 21-25. Further information from R. L. Forney, General Secretary, National Safety Council, 425 N. Michigan Avenue, Chicago 11, Ill.

National Society of Professional Engineers. Fall Meeting at the Grand Pacific Hotel, Bismarck, N. Dak., October 17-19. Details from Kenneth E. Trombley, NSPE, 2029 K Street, N. W., Washington 6, D. C.

National Warm Air Heating and Air Conditioning Association. Forty-fourth Annual Convention at the Morrison Hotel, Chicago, Ill., November 21-22. For information write the association, 640 Engineers Building, Cleveland 14, Ohio.

Society for Experimental Stress Analysis. Annual meeting at the Hotel El Cortez, San Diego, Calif., October 9-11. Further information from Dr. W. M. Murray, Secretary-Treasurer, Society for Experimental Stress Analysis, P. O. Box 168, Cambridge 39, Mass.

Applications for Admission to ASCE, Aug. 3-31

Applying For Member

Rudolph Aebi, Jr., Baghdad, Iraq.
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Milton Paul Krahl Barschdorf, Vicksburg, Miss.
Richard Norman Bergstrom, Chicago, Ill.
Lewis Rees Brooks, Baghdad, Iraq.
G. Walker Burgess, Ridgecrest, Calif.
Albert Warrne Carleton, Dallas, Tex.
John Paul Cooney, Evanston, Ill.
Jack M. Crook, Baghdad, Iraq.
Joseph Barrow Cyrus, Norfolk, Va.
John Bucknam Drisko, Maplewood, N. J.
Glenn Harding English, El Paso, Tex.
William James Grady, Beaver, Pa.
Curtis Selby Halphill, Charlotte, N. C.
Loyd Weldon Hamilton, El Paso, Tex.
Robert Wolcott Harding, San Antonio, Tex.
John Alpine Harvie, St. Louis, Mo.
Robert Cossin Johnston, New York, N. Y.
David Herbert Miller, Pittsburgh, Pa.
George Sutherland Nolte, San Jose, Calif.
Takeshi Okamoto, Tokyo, Japan.
John Lloyd Person, Washington, D. C.
Joseph Harrison Pigford, Birmingham, Ala.
Dale Casper Ryman, Millbrae, Calif.
Richard Hornbrook St. John, Houston, Tex.
Clarence Henry Scranton, Ambridge, Pa.
William Barret Settoon, New Orleans, La.
Willard R. Sheldon, Muscatine, Iowa.
Clifford Ernest Simmons, Baltimore, Md.
Ray Redding Slocum, Jr., Mobile, Ala.
Amedee Lucien Verdonck, Oakland, Calif.
Clarence Olin Walker, Farmington, N. Mex.
Frank Edwin Wilson, Yuba City, Calif.
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Applying For Associate Member

Arvid Allen Anderson, Glen Ellyn, Ill.
Muhammad Athaullah, Peshawar, W. Pakistan.
Ferris William Bartels, San Diego, Calif.
Frits Arthur Bells, Tucson, Ariz.
Gouri Venkatasubbiah Bhanuprakash, Orissa State, India.
Marcel Bitoun, New Cumberland, Pa.
Jindrich Brezina, Caracas, Venezuela.
Robert Paul Brown, Lexington, Ky.
Ronald Milton Button, Tacoma, Wash.
John Richard Carroll, Eureka, Calif.
Jack Lincoln Clapsaddle, Marshalltown, Iowa.
Kenneth Cogan, London, England.
Icarany da Silveira, Rio de Janeiro, Brazil.
Frank Louis DiMaggio, New York, N. Y.
Edmund Eugene Downer, Glassboro, N. J.
Leslie Norman Francis, Herts, England.
Robert Franks, Newark, N. J.
Frederic Arnold Friedman, Mineola, N. Y.
Lester Herbert Gabbriel, Sacramento, Calif.
Franklin Zinnerman Glickman, Miami, Fla.
Alfred Grinbergs, Chicago, Ill.
Harry Gustkey, Detroit, Mich.
Jack Newton Hall, Santa Ana, Calif.
William Hooker Hawes, Chicago, Ill.
James Livesey Haydock, Niagara Falls, Ont. Canada.
Charles Russell Hebble, Walla Walla, Wash.
John Bronislaw Herbich, Minneapolis, Minn.
James Douglas Hetherington, West Covina, Calif.
William Charles Howe, Jr., Salt Lake City, Utah.
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Joseph Michael Kristoff, Smyrna, Tenn.
William Dale Lester, Tampa, Fla.
Robert Smith Loomis, Windsor, Conn.
Irving Mandel, San Francisco, Calif.
Edward John Middlebrough, Richland, Wash.
Gordon Kent Moellman, Worthington, Ohio.
Bernard Joseph Rynarzewski, Baltimore, Md.
Renato Sansoni, Rome, Italy.
John Albert Schuelke, Olympic, Wash.
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Mihalaki Bali, Istanbul, Turkey.
Charles Wesley Bryant, Hayward, Calif.
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Luis Arturo Merlo-Flores, New York, N. Y.
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Carson Kwok-Chi Moe, College Park, Md.
John Raymond Morris, Martinsville, Va.
Ulyse Lennard Pitre, Jr., Metairie, La.
Harry McKenzie Roper, Jr., Ft. Belvoir, Va.
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[Applications for Junior Membership from ASCE Student Chapters are not listed.]

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CATALOG DIGESTS of ENGINEERING and INDUSTRIAL interest

1 AERIAL MAPPING

Aero Service Corporation—Literature covering new and more economical applications of varied aerial mapping services is offered. These include aerial photography, topographic and planimetric maps from an aerial photographic base, precise aerial mosaics, and plastic relief maps. Services discussed are used in highway design, plant engineering, industrial development, city planning, and tax maps.

2 AERIAL MAPPING

American Air Surveys, Inc.—A publication is available describing the many uses which civil and consulting engineers can make of aerial topographic maps and photographs. Also illustrated are the latest 3-dimensional mapping instruments used to compile these contour maps from aerial photos.

3 AERIAL SURVEY

Air Survey Corp.—Technical literature on photogrammetry is available, and also specific literature describing its application to highway engineering, city planning, volumetric computations of large piles, tax assessment, transmission line location, and other special applications.

4 AERIAL SURVEYS

Hycon Aerial Surveys, Inc.—A series of bulletins is available as follows: Bulletin No. 3 "Photogrammetric Products from Aerial Surveys and their application for Engineering Purposes," which gives terminology and comparative data on standard photogrammetric engineering products; Bulletin No. 7 "Hycon Aerial Surveys Resources and Capabilities;" Bulletin No. 8 "Staff Competencies and Capabilities," which describes the resources of Hycon Aerial Surveys.

5 ALUMINUM GRATING

Borden Metal Products Co.—A new brochure by way of diagrams and photos illustrates the properties and uses of aluminum floor gratings. Also shown are tables of their specifications. A description of a new safety grating and new aluminum safety steps is featured.

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6 ALUMINUM GRATING

Kerrigan Iron Works, Inc.—A 4-page brochure of engineering data and a safe load table on spark-proof Kerrigan Weldforged aluminum grating-open flooring, and stair treads is offered. Light weight, non-magnetic, noncorrosive, this grating has no maintenance cost and its high strength insures many years of service. It is now manufactured in types and sizes of grating for every need; steel, stainless, monel, aluminum, riveted, extra close spaced and serrated.

7 ALUMINUM GRATING

Klemp Metal Grating Corp.—An all new 4-page brochure describes Klemp's RR (rectangular riveted) Aluminum Grating. Photos of actual installations and applications, descriptions, diagrams, safe load tables and complete specifications are included.

8 ASBESTOS-CEMENT PIPE

Keasbey & Mattison Co.—A new 4-page illustrated bulletin describes the K & M asbestos-cement pressure pipe which is non-metallic and chemically inert. The detailed text includes a description of the new "fluid tite" coupling with self-energizing rings that are tapered for ease of installation.

9 ASPHALT HANDBOOK

The Asphalt Institute—This 304-page manual, Construction Series 81, is the primer for all personnel engaged in asphalt construction. Among the subjects covered are: Uses of Asphalt; Tests; Paving Equipment; Design, Manufacture and Inspection of Plant Mixes; Design of Asphalt Pavements for Highways, and Airports; Asphalt Useful Tables; Specialty Uses; and Maintenance and Resurfacing. Price $1.50.

N. B. There is a charge for this book. Make checks payable to The Asphalt Institute.

10 ASPHALT LINER MANUAL

W. R. Meadows, Inc.—announces the availability of a new "Hydromat" Asphalt Liner Manual. The "Hydromat" Manual fully describes applications and contains installation information, necessary technical engineering data and specification information. This is not a sales catalog, but strictly a Technical Data Manual.

11 ASPHALT PLANT

Madsen Works—Catalog No. 800 shows complete specifications, description and illustrations of the Model 481 Asphalt Plant. This plant is available in capacities of 4000-lbs., 5000-lbs. and 6000-lbs. Plant features exclusive bin design, improved drive arrangement, and air operation of bin gates, asphalt pressure injection and mixer gate.

12 ASPHALT PLANT

Madsen Works—Bulletin No. 391 illustrates and describes the new Model 391 Hot Rod Asphalt Plant. This plant is available in 3000-lb, 4000-lb, and 5000-lb capacities. This outstanding portable batch type asphalt plant features simple, streamlined design, fully enclosed gear box reduction unit, automatic operation (available as optional equipment), Twin-Shaft Pug Mill Mixer and many other engineered advancements.

13 ASPHALT PLANT

Madsen Works—Catalog No. 20-S illustrates and describes the 2000-lb. SPECIAL Asphalt Plant. The plant is rated at 60 tons per hour, yet consistently produces in excess of 80 tons per hour. It is a portable plant, ideal for the not-too-large contractor, the municipality, and the large asphalt producer who has in mind a small permanent operation for producing about 480 tons per day.

Mail This COUPON To-day

CIVIL ENGINEERING Date.....
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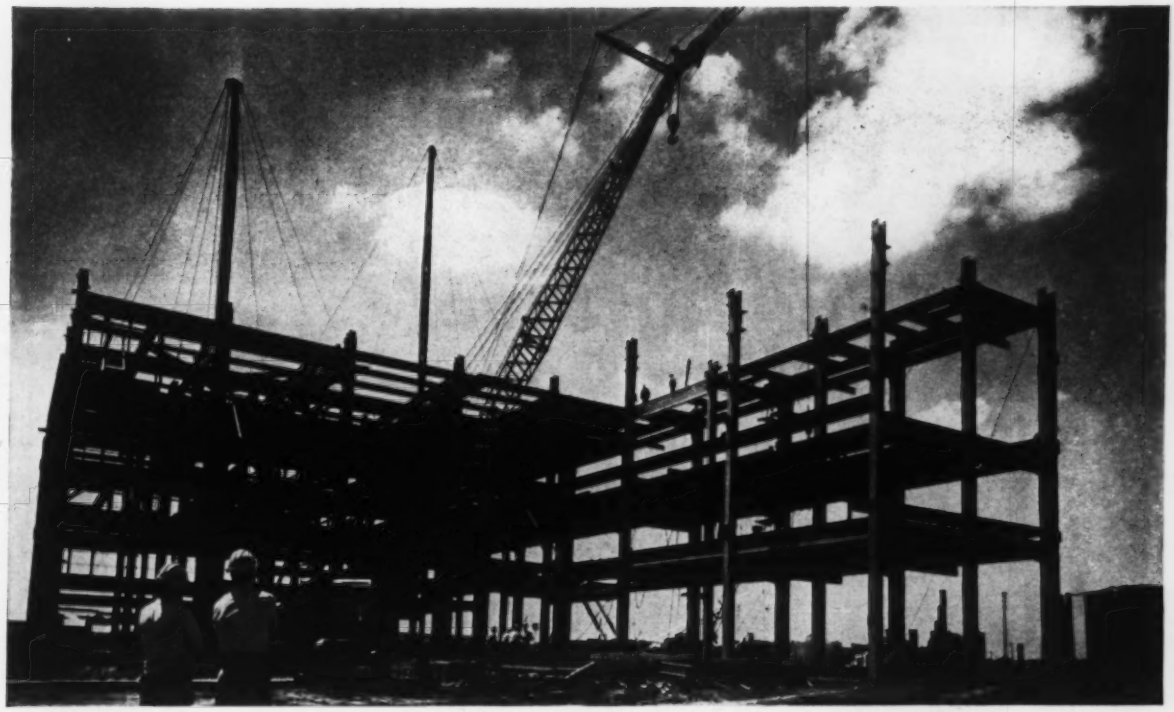
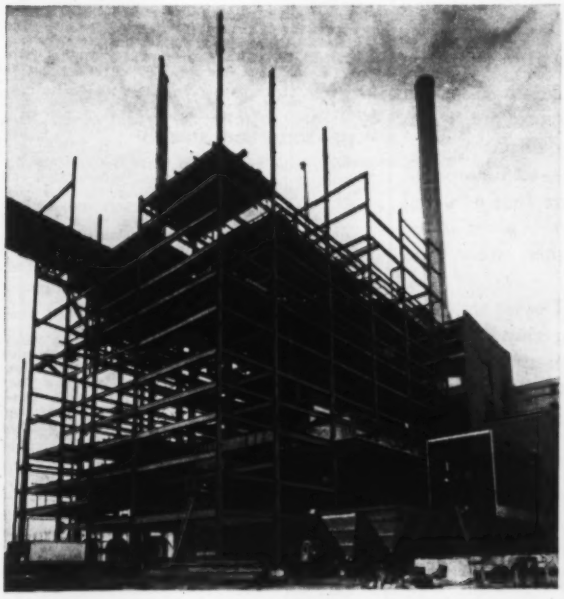
NOT GOOD AFTER November 15, 1957, for readers in the U. S., but requests will be accepted to December 31, 1957, from readers outside of this country.

Use This Free Service—Mail The Coupon To-day

TWO NEW POWER PROJECTS



WATTS COMING AT PHIL-ELEC—Electric power industry history is being made on the banks of the Delaware River at Eddystone, a few miles south of Philadelphia. Work is well under way here with the mammoth steel framework for buildings to house the world's largest and most efficient turbine generators. These Philadelphia Electric Company units, to be operated at super-critical pressure and temperature, will produce 325,000 kilowatts each at the record-breaking rate of two-thirds of a pound of coal per kilowatt-hour.



In the photograph Bethlehem erection crews can be seen at work on the boiler house for Unit #1. They will proceed to erect steel for the huge turbine room, then begin similar work for a second generating unit of equal size. The total steel requirements will approximate 8000 tons, erected by high-strength bolting. Unit #1 is planned for operation in 1959, with Unit #2 to follow in 1960.

General contractors: United Engineers & Constructors, Inc.

EDISON ADDS A BIG ONE—A turbine generator with net capability of 305,000 kw, larger than any now in operation in the U. S., will be housed in this whopping big addition to Commonwealth Edison Company's station in Waukegan, Ill. The utility expects to place the unit into operation in summer of 1958.

The steel framework for the structure was nearing completion when the photograph was taken. Bethlehem ironworkers, using high-strength bolts for field erection, had placed much of the nearly 4000 tons of structural steel required for the job. Steel erection began Jan. 2 and was completed early in July.

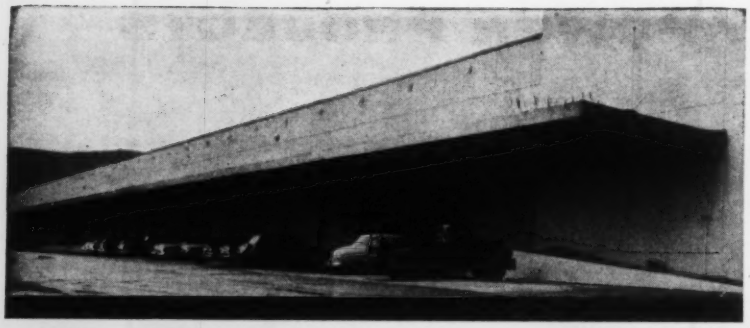
Consulting engineers: Sargent & Lundy.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

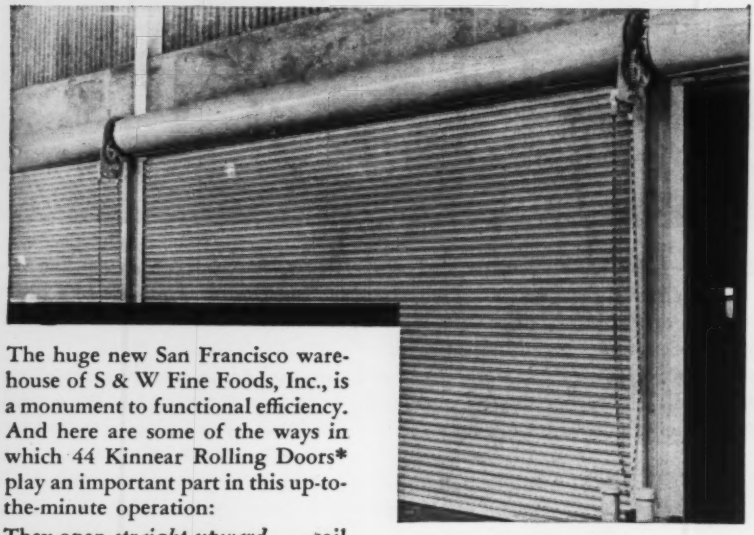
BETHLEHEM STEEL

BETHLEHEM STEEL



44 Kinnear Steel Rolling Doors

Speed Service at S&W Fine Foods —



The huge new San Francisco warehouse of S & W Fine Foods, Inc., is a monument to functional efficiency. And here are some of the ways in which 44 Kinnear Rolling Doors* play an important part in this up-to-the-minute operation:

They open *straight upward* . . . coil smoothly out of the way *above the opening* . . . clear the *entire* doorway quickly — from jamb to jamb and from floor to lintel.

They stay *out of reach* of damage by wind or vehicles.

All floor and wall areas around the doorway are *always* fully usable.

Ceiling space around openings remains clear at *all times*. There's never any interference with cranes, hoists, conveyors, lighting, or other overhead equipment. Goods can be stacked "clear to the rafters" inside or outside the opening.

The tough, flexible, all-steel curtain of interlocking slats assures *long* service, *low* maintenance costs, and *extra* protection against fire, wind, intrusion, and vandalism.

Heavy galvanizing—1.25 ounces of pure zinc per square foot of metal (ASTM Standards) — gives added resistance to weather, wear, and corrosion.

Kinnear Rolling Doors are built any size, for old or new buildings, with motor or manual control. Write for information, or for recommendations on your door needs.

*33 Kinnear Steel Rolling Doors 18'9" wide by 10' high, ten doors 10' wide and 10' high, and one door 6' wide by 7' high.

KINNEAR ROLLING DOORS — Saving Ways in Doorways

The KINNEAR Mfg. Co.
FACTORIES:
1080-90 Fields Ave., Columbus, Ohio
1742 Yosemite Ave., San Francisco 24, Calif.
Offices and Agents in All Principal Cities

CATALOG DIGESTS

14 AUGER DRILLS

The Salem Tool Company—Earth and rock boring auger drills are described in Bulletin M-105. Features of horizontal blast hole drills are explained, as are the following features of truck-mounted and self-propelled drills: power unit, transmission, main drive case, carriage, main frame, hydraulic unit and elevating jacks.

15 AUTOMATIC COUPLERS

Mayo Tunnel & Mine Equipment—A simple and economical automatic coupler for small mine cars is described in a recent brochure. In addition, side-dump cars, rocker-dump cars, car passers, pneumatic grouters, and muck bins are explained and illustrated.

16 AUTOMATIC GATES

Thompson Pipe & Steel Co.—This catalog illustrates and explains 3 devices which control upstream and downstream water levels and flow without usual floats and supervision. On-the-job photos and diagrams show the many irrigation and water-works applications. These gates are made on the widely-adapted Neyrpic principle.

17 AUTOMATIC VALVELESS FILTER

The Permutit Co.—Bulletin 4351 describes the company's new completely automatic gravity sand filter for municipal or industrial water treatment. Uses no valves, pumps or flow controllers. Costs less than conventional manual filters. Also reduces costs of installation, operation, maintenance and expansion. Produces uniform, high-quality effluent. Sizes to 400 gpm.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME!

18 BELT CONVEYORS

Link-Belt Co.—Pre-Blt sectional belt conveyors in standardized, pre-engineered units with capacities ranging up to 1,500 tons per hour are described in a new book. These conveyors incorporate standard Link-Belt components, including the new Series 50 idlers, packaged with sectional truss frames and structural steel supporting bents. They are built in 18, 24, 30 and 36-in. belt widths, with 24 42-in. deep trusses. Drives range up to 50-hp.

19 BOILER AND STOKERS

The James Leffel & Company—Complete descriptive and specification information on rugged Scotch boilers for gas, oil and coal firing and automatic underfeed stokers for Scotch type boilers is given in a 28-page bulletin 236. This richly illustrated brochure includes test results, performance data, and complete details of design and construction.

20 BORINGS

Raymond Concrete Pile Co.—A booklet "Subsoil Investigations for Foundations" Catalog B-6 explains the reason for subsoil investigations, what Gow borings are and how they are made, and the results obtained. Illustrated are methods for making borings and taking samples, and various types of rigs in operation.

21 BRIDGE CONCRETING

The Master Builders Co.—Bridge concreting is the theme of a 16-page reporter recently published. Case histories of some 280 bridges are covered in five stories with construction photographs. The stories cover concreting of piers and bridge decks for highway and railway bridges, and include discussion of hot and cold weather concreting; the use of lightweight aggregate; placing and finishing problems; and the role played by Pozzolith in controlling concrete quality for bridge work.

Here, for the first time, is a complete valve and remote control system — now offered as a "packaged" unit by S. Morgan Smith Co. It is designed to satisfy two basic applications, either singly or in combination:

Where you need precise positioning and indication.

Where you need remote control.

The system is made up of three elements: an SMS-Rotovalve or R-S Butterfly Valve, a "packaged" hydraulic positioner or electric motor operator installed next to the valve, and a master remote control and indicator unit, that may be located anywhere from a few hundred yards to many miles away.

For either modernization or new construction, this system makes possible savings in supervisory costs at remote stations, gives better operating control, and increases pumping efficiency. It is suited to:

Pressure control
Flow control
Pump check service
Throttling on a pump
Reservoir control
Altitude control
Sump level control
Effluent control
Filter water influent level control

To obtain full information on the completely new SMS valve and remote control system, ask for Catalog 164. It is available without charge through any of our representatives, or you may write to S. Morgan Smith Company, York, Penna.

S. MORGAN SMITH SMS HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

7

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

22 BRIDGE FLOORING

American Bridge Division—This 32-page booklet contains complete engineering drawings and design data for all available I-Beam-Lok sizes, plus detailed coverage of Specifications, including the type of steel, erection, fabrication, painting, field assembly and welding. A brief discussion of composite T-beam action between I-Beam-Lok flooring and steel stringers is also included.

23 BUILDING MATERIAL

U. S. Durox Corp. of Colorado—A new 12-page booklet contains the complete story of Durox, a compound of various silicates, the result of which is a homogeneous mass which in its merchantable state is a bulky solid, comprised of many tiny spherical voids, each surrounded by connecting films of calcium hydro-silicate. The booklet gives full and accurate data concerning this lightweight building material: manufacturing process, insulation properties, acoustical properties, workability, etc.

24 BUILDING SAVERS

L. Sonneborn Sons, Inc.—An eight-page brochure of building construction and maintenance data covering the company's waterproofings, floor treatments, admixtures and protective coatings. The product descriptions include definitions, directions, advantages, coverage and specifications. Known as Building Savers, these quality products are the tested solutions to your building construction and maintenance problems.

25 BUTTERFLY VALVES

Leopold Co., Inc.—Rubber seated butterfly valves is the subject of a new 4-page brochure. Made in sizes 6 to 72-in., Leopold Butterfly Valves are designed for positive drop-tight shut off, easy economical installation, long life and low maintenance. Construction, applications, manual or automatic operation and factory testing are discussed in the brochure.

26 CABLE SUPPORT

Globe Co.—Two systems of support for all types of cable, wiring and tubing are described in an 8-page illustrated catalog. These systems have been engineered to be used interchangeably with each other depending on the weight of the load to be supported at any given location. Globe-Tray, the ladder type tray and Cable-Strut, the basket type are fully described with complete load charts.

27 CARPULLERS

Superior-Lidgerwood-Mundy Corp.—A new 24 page, 2 color bulletin C-616 "Carpullers for Easy Moving Rolling Loads" has just been issued, with descriptions, illustrations, data, tables and specifications for Carpuller requirements. Illustrates and describes the Electric Capstan Carpuller for car moving, barge moving, pipe bending or any haulage of similar nature; also Tugmore Capstans, Horizontal Head type Capstan Carpullers, Drum Type Carpullers, Friction Drum Type Carpullers, etc.

28 CAST IRON PIPE

U. S. Pipe & Foundry Co.—An 8-page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids. The newly developed Tyton Joint is simple, sturdy, and tight. Illustrations show details of joint and method of assembly.

29 CAST IRON PIPE, HYDRANTS AND VALVES

R. D. Wood Company—A new general catalog has recently been issued providing full details of weights and dimensions of "sand spun" cast iron pipe and cast iron fittings. This catalog also features fire hydrants, gate valves and other products manufactured by this company.

30 CEMENT INTENSIFIER

Insuro Chemical Co.—Insuro is a liquid chemical compound, the ingredients of which, in chemical combination with Portland cement, accelerates and more completely hydrates the cement particles, thereby producing a stronger and more dense concrete. Literature is now available giving a detailed description of the properties and uses of this multi-purpose chemical emulsion.

31 CENTRIFUGAL, TURBINE-TYPE PUMPS

Aurora Pump Div., The New York Air Brake Co.—The current line of centrifugal and turbine-type pumps is comprehensively presented in a 4-page Condensed Catalog and Selection Guide. A unique selection table indicates which types of pump will meet certain capacity and head demands. Each pump is illustrated (some with a statement of applications, capacities and heads). Bulletin identification references are provided where detailed information regarding given pump types is desired.

32 CLARIFIERS

General Filter Co.—A new 10-page bulletin of information on clarification, waste treatment and water softening by the Contraflo or upflow clarification method has been released. This method's suitability for boiler feed, cooling systems, refineries, paper manufacture, textile industry, chemical plants and many other similar applications is particularly outlined.

Return the coupon today!

get concrete facts about concrete handling

...ASK FOR GAR-BRO CATALOG NO. 300

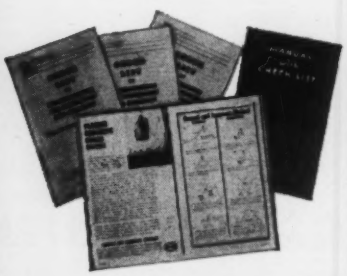
This colorful 34-page catalog features Gar-Bro's complete line of over 300 items. Has simple, fast reading list of equipment features. Shows proper handling methods for cutting concrete placing costs. It's the most complete catalog of concrete handling equipment ever compiled.

Ask your Gar-Bro dealer or write for free copy.

ASK FOR THE GAR-BRO MANUAL

This 56-page "Manual for Handling and Placing Concrete" is a condensed handbook which illustrates and describes all phases of concrete construction methods. It includes complete check lists of job specifications, conditions and summary. In addition, there is current technical data, useful tables and comparative concrete placing methods.

Ask your Gar-Bro dealer or write for free copy.



GAR-BRO MANUFACTURING COMPANY

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Los Angeles 21, Calif.
Branch
1600 N. Adams St., Peoria, Ill.

CATALOG DIGESTS

33 CLAY PIPE WARM AIR HEATING DUCTS

National Clay Pipe Mfgr., Inc.—A completely illustrated installation manual for underfloor slab dust heating systems is now being offered. This 2-color, 12-page booklet contains specifications, dimensions and detailed illustrations and plans for calculating and installing clay pipe warm air heating duct systems.

34 CLEARING BLADE

Rome Plow Co.—A new cut and pile clearing principle is discussed in a 4-page bulletin which describes the Rome K-G clearing blade. Photographs show the K-G blade in action. Complete specifications are given.

35 COAL RECOVERY DRILLS

The Salem Tool Company—Bulletin M-101, a four-page, two-color pamphlet describes coal recovery drills 16-in. to 42-in. in diameter for 6-in. augers. Photographed are a heavy-duty barrel-type drill head 42-in. in diameter with tungsten carbide 3-prong pilot adjustable core burster, reinforced double auger flighting, barrel equipped with bug dust clearance spirals; and a 36-in. heavy-duty nut and slack drill head for drilling rock and producing nut and slack coal.

36 COFAR STEEL FORM

Granco Steel Products Co.—New product manual, BC-571, gives comprehensive data on modern development in reinforced concrete floor systems. Cofar, a high-strength steel form and reinforcing unit, eliminates the time, material and money expended in costly form work. It provides speed and sureness in the design and construction of concrete floors by combining three remarkable features in one unique product.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

37 COFFERDAMS

Spencer, White & Prentis, Inc.—"Cofferdams," by Lazarus White and Edmund Astley Prentis is a trusted source-book covering actual design and construction of cofferdams as well as the theoretical features. The price is $10.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

38 COLD-WEATHER CONCRETING

Sika Chemical Corp.—Complete information on accelerating the set of concrete for cold-weather construction is now available. Test data specifications and detailed information on Sikacrete Accelerating Densifier are included.

39 CONCRETE ACCESSORIES

Superior Concrete Accessories, Inc.—Now available is new literature which features accessories and devices for lifting prestressed and precast concrete, including a 4-strut coil rod anchor and coil loop inserts. Also featured is Superior's "hold-down" anchor for restraining wires and cables in pre-stressed beams and girders.

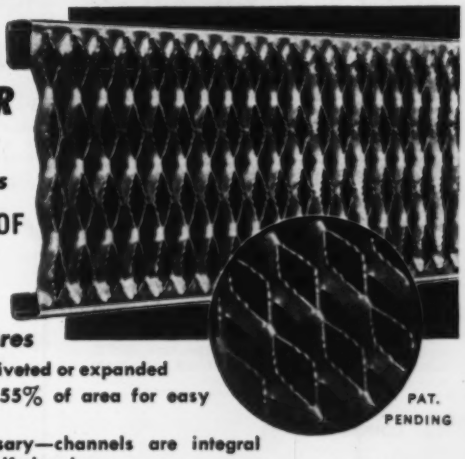
40 CONCRETE ADMIXTURES

Sika Chemical Corp.—A 20-page booklet "Proper Use of Concrete Admixtures," outlines the reasons for using admixtures under various job and temperature conditions. Laboratory data, field data, and numerous graphs are included.

two superior open steel
FLOOR GRATINGS
BY GLOBE

1 Safety GRIP-STRUT®

FOR MAXIMUM SAFETY ALL OVER YOUR PLANT



Important Safety Features

★ FIRE PROOF ★ SLIP PROOF
★ MAXIMUM STRENGTH
★ MINIMUM WEIGHT

Important Economy Features

★ All one piece, not welded, riveted or expanded
★ Open space in excess of 55% of area for easy access of light and air
★ No extra supports necessary—channels are integral part of the material. ★ Self cleaning
★ Cut and installed like lumber by your own maintenance force. ★ Low in original cost. ★ For balconies, no secondary sprinkler heads needed

PAT. PENDING

Ideal for work platforms, stair and ladder steps, flooring, balconies, catwalks, machinery guards, fire escapes and for original equipment safety treads.

2 GOLD NUGGET® WELDED grating
PAT. PENDING

The QUALITY GRATING for Heavy Duty Applications

★ 3/16" projection weld nugget for greater rigidity and strength
★ Vertical alignment of the main load bar assured
★ All bars are load carrying bars including secondary bars
★ Anti-skid pattern

PROJECTION WELD

Each secondary load bar (A), as projected welded to the primary load bar (B) has a shear strength of 5,000 pounds per weld. There are 28 such projection welds to a square foot of grating. This means that GOLD NUGGET Welded Grating can sustain greater shock loads than other gratings.

10,000 POUNDS

For the complete details of these revolutionary new gratings, write for new catalogs today. Distributors in all principal cities. Consult the yellow pages in your phone book under "GRATING".

108

PRODUCTS DIVISION
The GLOBE Company
MANUFACTURERS SINCE 1914
4044 SOUTH PRINCETON AVENUE • CHICAGO 9, ILLINOIS

41 CONCRETE BONDING

Larsen Products Corp.—Weld-Crete, which bonds new concrete to old concrete permanently, is the subject of an 8-page illustrated folder. A complete description as well as proof of its performance is included. This liquid agent also bonds new concrete to brick, wood, masonite, gypsum board, concrete block, metal ceramic tile, glass and many other surfaces.

42 CONCRETE FORMING ON SEWAGE PLANTS

Universal Form Clamp Co.—A 4-page bulletin points out the advantages of the Uni-Form Panel System in forming circular walls and Y walls on sewage treatment plant jobs.

43 CONCRETE FORMING SYSTEM

Economy Forms Corporation—A catalog with pictures is offered showing a complete forming system available to contractors on a purchase basis. The easy adaptability of these forms to all types of form work, plus engineering layout service on each new project, together with a complete steel form good for a lifetime of service makes the new EFCO form an attractive investment for the large and small builder.

44 CONCRETE FORMS

Universal Form Clamp Co.—A 32-page catalog points out to contractors the many features of Uni-Form Concrete Forms. It illustrates how forms are erected and stripped, gives a variety of applications and data explaining how Uni-Form Panels form concrete rapidly and economically.

45 CONCRETE FORM TIES, ACCESSORIES, ROAD BASKETS

Universal Form Clamp Co.—A 32-page catalog containing a complete line of form ties and concrete accessories. Catalog features form design table and formula for developing stud wale and tie spacings.

46 CONCRETE HANDLING EQUIPMENT

Gar-Bro Mfg. Co.—A profusely illustrated 36-page catalog 300, containing specifications for more than 300 items of concrete handling equipment is now available. Serving as a job conditions and specifications guide, it features concrete buckets, chutes and hoppers, bucket attachments, powered crane hooks, carts, wheelbarrows, bins and batchers, paving vibrators, industrial wheels and other equipment.

47 CONCRETE PAVEMENT MANUAL

Portland Cement Association—This 72-page illustrated manual gives details of geometric pavement designs and outlines the best methods of construction. It presents in summarized, usable form, data on pavement layout and construction from recent technical society proceedings, engineering publications, field observations, tests and experience.
(Sent in U. S. and Canada only.)

48 CONCRETE PRECISION BUMP CUTTERS

Concut Sales, Inc.—A new 2-page catalog illustrates and describes the concut precision bump cutter which quickly and efficiently eliminates bumps from concrete and asphalt surfaces within the tolerance of ⅛-in. deviation in 16-ft. It also develops varying degrees of surface texture by adjusting the width of the spacers between the diamond blades.

49 CONCRETE PRESSURE PIPE

Price Bros. Co.—A 24-page book that explains and illustrates how prestressed concrete cylinder pipe is made, how the pipe is laid and the advantages of concrete pressure pipe also includes cut-away diagrams showing the construction of the various types of concrete pipe and the flexible, watertight joint. A table of types and sizes gives helpful information for selecting pipe.

50 CONCRETE REPAIR

Masonry Resurf. & Cons. Co., Inc.—"Iron Girdle Holds Concrete for Bridge Pier Repair" is a reprint illustrating the methods and techniques of "in the dry" repair of a 24-ft dia pier near Baltimore, Md. These procedures which revitalize deteriorated structures adding many years of useful life to an old structure are similar to those utilized in the "Dri-Por" system of pile repair. Many illustrations clearly show the work in various stages of repair.

51 CONCRETE SAWING EQUIPMENT

Concut Sales, Inc.—A new bulletin illustrates and describes the complete line of Concut Concrete Sawing Machines, Supreme Diamond Blades and Abrasive Blades. Included in the line is the Model R-85 Lightweight machine for sawing concrete up to 3-in. in depth, Model-S-200 Standard machine for sawing up to 5-in. in depth, the Self-Propelled Concut and the Jointmaster for large air base and highway sawing jobs.

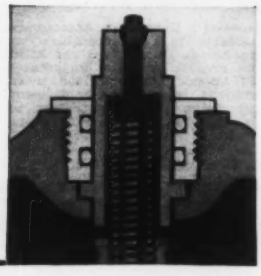
52 CONCRETE SHORE PROTECTION

Portland Cement Association—Engineers and officials concerned with beach erosion control will be interested in an illustrated 30-page booklet on the use of concrete shore-protection structures. The booklet presents a discussion of wave action as well as other factors influencing the type and design.
(Sent in U. S. and Canada only.)

AS NEAR AS PERMANENT

The R. D. WOOD Standard Swivel-Joint Hydrant

R. D. Wood Hydrants are available with mechanical joint or flange-type pipe connections. Also with O-Ring Seal when specified (shown below).



53 CONCRETE TESTING EQUIPMENT

Forney's Inc., Tester Div.—A complete line of low cost precision compression and flexure testers for cylinders, pipe, beams and blocks is the subject of a new bulletin. New models, available for the production testing of high strength concrete cylinders according to ASTM and AASHO specifications, are also described.

54 CONCRETE TESTING MACHINES

Soiltest, Inc.—A comprehensive 8-page bulletin illustrates and describes concrete testing machines and accessories, as well as units designed for field or laboratory use in testing cylinders, cubes, blocks and beams. Other items include air entrainment meters, kelly balls, flexure and cube attachments, beam forms, cylinder molds, capping sets, curing cans, and slump test sets are shown.

55 CONCRETE WATERSTOPS

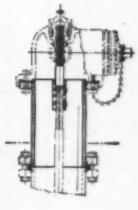
Water Seals, Inc.—Labyrinth Waterstops are manufactured of polyvinyl plastic, which helps maintain a constant, strong, watertight bond between concrete joints. A new catalog describes the convenient features of Labyrinth Waterstops, including those which render it resistant to age, chemical and weathering changes. Blueprint type specification drawings include the Labyrinth, Plextrip, Cellular and Dumbbell waterstops in their various sizes. A table lists the recommended joint application and water head for each size and kind of waterstop.

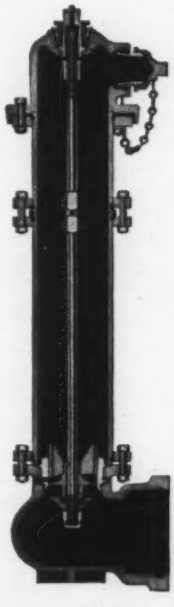
YOU CAN GET TO A LOW-COST INSTALLATION

This hydrant will give you reliability, strength and permanence at lowest possible cost. It assures your community of water delivered at top pressure, because internal friction is reduced to the minimum. Generous size of all water carrying areas, carefully rounded changes of diameter, and scientifically tapered nozzleways all contribute to reducing friction well below A.W.W.A. specifications.

EXTENSION PIECE

The extension piece may be inserted (without shutting off water supply) between hydrant head and barrel or between barrel and elbow.





BREAKABLE FLANGE AND STEM COUPLING

Available at slight extra cost and designed to snap under a blow which would otherwise smash the hydrant beyond repair, thus depriving the community of fire protection for a dangerous length of time. Flange and stem coupling can be replaced in a jiffy *without excavating.*

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)

56 CONSTRUCTION EQUIPMENT

Seaman-Andwall Corp.—has issued a catalog covering their complete Sta-Bilt line of construction equipment. Illustrated and described are the Pulvi-Mixer, Trav-L-Plant, Steel wheel, and pneumatic self-propelled rollers, materials spreaders, rock breaker and the Vibro-Joint cutter for making contraction joints in concrete paving.

57 CONSTRUCTION MATERIALS

Texas Vitrified Pipe Company—A comprehensive, 32-page catalog lists complete Tex-Vit line of vitrified clay pipe, clay pipe fittings, glass-lined clay pipe, bituminous and plastic "Jiffy-Joints" for clay pipe, Wedge-Lock plastic joints, channel pipe, perforated pipe, translot filter blocks, flue lining, chimney pipe and fittings, flue rings, fire brick, fire clay, clay pipe heating and ventilating ducts, wall coping and related clay products. Useful reference material also is included.

58 CONTRACT PUMPING

American Dewatering Corp.—A new and well illustrated catalog describing the predraining of many construction projects of typical and unusual interest. Outlines the services and benefits of contract pumping in which this company specializes.

59 CORE DRILLS

Acker Drill Co., Inc.—Acker Bulletin 30 describes the Toredo core drill. The basic Toredo rig can be equipped with either a hydraulic or mechanical screw feed. Power plant can be either gasoline, diesel, air or electric motor. The unit is readily adaptable for mounting on drag skid, jeep, truck or trailer.

60 COST DATA

Barco Manufacturing Company—Of interest to earthmoving contractors is a bulletin of cost data for soil compaction in restricted areas. Specifications accompany the data.

61 CURB AND GUTTER LAYING

E. L. Hardin Associates, Inc.—Literature is now available describing the Smith-Field Automatic Curb & Gutter Machine for laying integral curb and gutter without forms or hand finishing and the Stephens-Canfield Automatic Curber for faster curb laying without forms and using asphaltic or Portland cement concrete. On-the-job photographs show these machines in action. Complete specifications and data are included in the new literature.

62 CURTAIN-WALL DATA

The William Bayley Co.—Aluminum wall, curtain-wall and steel window wall systems are the subject of a new data reference file. Included are three brochures with specifications and detailed information as well as several folders of diagrams illustrating various window and curtain-wall systems.

63 DEPTHOMETER, CAMERA, LOCATOR

Bludworth-Marine—Literature describing the new single transducer survey depthometer ES 130, which is portable, weighs under 40-lb and performs with great flexibility and precision, is now available. Also provided is information on an underwater TV camera with a continuous picture on monitor screen on boat or land, with depths to 180-ft; and a metal locator which pinpoints ferrous and non-magnetic metals in fresh and salt water. Pressurized to depths up to 160-ft, this locator weighs 1½-lb submerged.

There are 260 Digest items on pages numbered 136 to 164. Read all items for the literature of interest to you.

64 DESIGN DATA ON SUSPENSION SYSTEMS

John A. Roebling's Sons Corp.—A 22-page booklet, which is specific to wire, strand and rope used on guyed structures and suspended systems of all kinds, except gigantic suspension bridges, consists of chapters on galvanized wire, bridge strand, bridge rope, fittings, and special fittings. Fully diagramed, it includes complete specifications.

65 DESIGN MANUAL

W. R. Meadows, Inc.—has prepared a new manual entitled "Design Techniques for Controlling Moisture in Building Structures." This manual, prepared by a firm of technical engineering writers, was originally planned to sell for $1.00 per copy. However, as this problem is of vital interest to all in the construction industry, this company will now send a free copy to all architects, engineers and builders who desire a copy for their file.

66 DESIGN OF CONCRETE AIRPORT PAVEMENT

Portland Cement Association—This 48-page booklet on the design of concrete pavement for airports presents design charts for determination of pavement thickness and concrete resurfacing. Also included are recommendations for jointing layout, the use of sub-base under concrete and the evaluation of existing pavements.

(Sent in U. S. and Canada only.)

67 DOCKS, WHARVES AND MOBILE DRILL BARGES

DeLong Corporation—A new 20-page, profusely illustrated booklet describes the DeLong method of installation of prefabricated docks, wharves and other structures including mobile offshore drill platforms raised by means of the DeLong Jack. Also describes the famous Texas Tower project, a mobile aerial cableway system and other commercial and military installations.

68 DOWEL BASKET ASSEMBLY

Universal Form Clamp—New heavy duty type dowel basket assembly has been approved by many State Highway Departments including Illinois, Michigan, Wisconsin and Ohio. New assembly has been used on toll roads and on the Ohio and Indiana Turnpikes. Completely assembled and welded units are furnished along with all other transverse and longitudinal joint requirements such as stake pins, base plates, construction or expansion materials, hook belt assemblies or tie bars.

69 DRAIN GRATES

Irving Subway Grating Co., Inc.—A recently published four-page, two-color folder illustrating the use of open mesh steel flooring as drain grates is now available. The folder contains photographic illustrations and shows typical uses of drain grates. There are engineering drawings of the various types and complete technical data to facilitate estimates and specifications.

70 DRAWING INSTRUMENTS

Fennel Instrument Corp. of America—This firm offers a new line of drawing instruments for architects and engineers. Packaged in colorful simulated leather cases, these instruments are made by Maho, one of the finest companies in West Germany. New literature is available describing the line which is complete from flat and square types for the professional down to the inexpensive school set.

71 EARTH MOVER

Yuba Mfg. Co.—A new 4-page bulletin, which includes photographs, diagrams and a detailed text, shows the versatility of the Movall, a heavy earth mover. Positive ejection, greater stability, easy maneuverability, safety at high speeds and ability to handle any material are among the features highlighted.

72 ELIMINATE DESTRUCTIVE MOISTURE

W. R. Meadows, Inc.—The practical solution to the problem of eliminating destructive moisture in all types of construction is fully explained in the brochure, "Sealtight Products For Better Construction." This brochure contains complete product information, installation information, installation drawings and architectural specifications.

73 ENGINEERING CAREERS

Chemstrand Corp.—"The Chemstrand Story" describes the functioning of the Chemstrand Corp., which produces Acrilan fiber and nylon yarn. Positions for engineers, including those for civil in the construction of new plants, equipment, buildings and additions, are also outlined.

74 EXPANSION PLATES & BUSHINGS

Lubrite Div., Merriman Bros., Inc.—Manual No. 55 contains complete information, technical data, and specifications about self-lubricating expansion plates and bushings for bridges, buildings, refinery equipment and chemical processing equipment applications.

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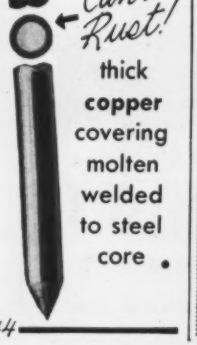

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COPPERWELD STEEL COMPANY
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Write for Bulletin 144

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CATALOG DIGESTS

75 EXPLOSIVES FACT BOOK

Atlas Powder Co.—A complete line of explosives products is described in a new 48-page catalog that includes facts and figures to assist users in their selection. Containing more than a score of tables and over 100 illustrations, the book summarizes the most effective and economical explosives materials and methods as employed in 9 major industries, including mining, quarrying, construction, seismic prospecting and pipelining.

76 EXTRUDED GRATING

Washington Aluminum Co., Inc.—An eight-page booklet in color describes the many uses of gratings and treads of aluminum. Extruded grating is a most versatile product since its various depths, and punchings make them suited for marine industrial and commercial applications. Specifications and a safe tread table are included.

77 FIBRE FORMS

Sonoco Products Co.—Uses of Sonotube, fibre forms, are illustrated in a new brochure. These fibre forms provide an economical method of forming round, obround, half-round and quarter-round columns. Also encasement of steel and wooden piles, existing columns and utility risers. Available in several different types, the newest which provides a form surface requiring little or no rubbing of the finished column. Technical data also available.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME!

78 FIBRE TUBES

Sonoco Products Co.—Sonovoid, fibre tubes, were specifically developed to form voids in bridge decks; wall, floor, roof and lift slabs and in concrete piles. Uses illustrated in a new brochure. Sonovoid, fibre tubes, are used in precast or cast-in-place units of conventional or pretensioned construction. Tie down and spacer method shown along with design data for 8-in. and 12-in. slabs. Other technical data available.

79 FILTER MEDIA

Anthracite Equipment Corp.—A new bulletin on "Anthrafilt" tells the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Information about a free technical advisory service is included.

80 FIR PLYWOOD DIAPHRAGMS

Douglas Fir Plywood Assoc.—A completely new publication on Fir Plywood diaphragms has just been released. Written by engineers for engineers, it is an easy-to-use, handy-to-file, 10-page folder describing the importance and function of diaphragm construction, the advantages, how they are designed and their comparative cost. Suggested specifications are also included.

81 FLOOR ARMOR

Irving Subway Grating Co., Inc.—Just published is a new catalog on Gridsteel floor armor. Gridsteel is made of steel bars on edge, bent and joined together in a continuous hexagonal mesh pattern. Floors armored with Gridsteel last indefinitely. Gridsteel prevents ruts or potholes from forming, gives an even tractional floor surface at all times. Catalog illustrates uses, advantages, and shows how quickly and simply Gridsteel is installed.

82 FLOOR GRATING AND STAIR TREADS

Kerrigan Iron Works, Inc.—A 16-page catalog gives a picture story of Weldforged grating and stair treads with continuous spiral cross bars alternating right and left, and slightly above bearing bars for extra safety. Electronically weldforged into solid, one-piece units for strength and durability. Contains safe load table, engineering data on both grating and treads.

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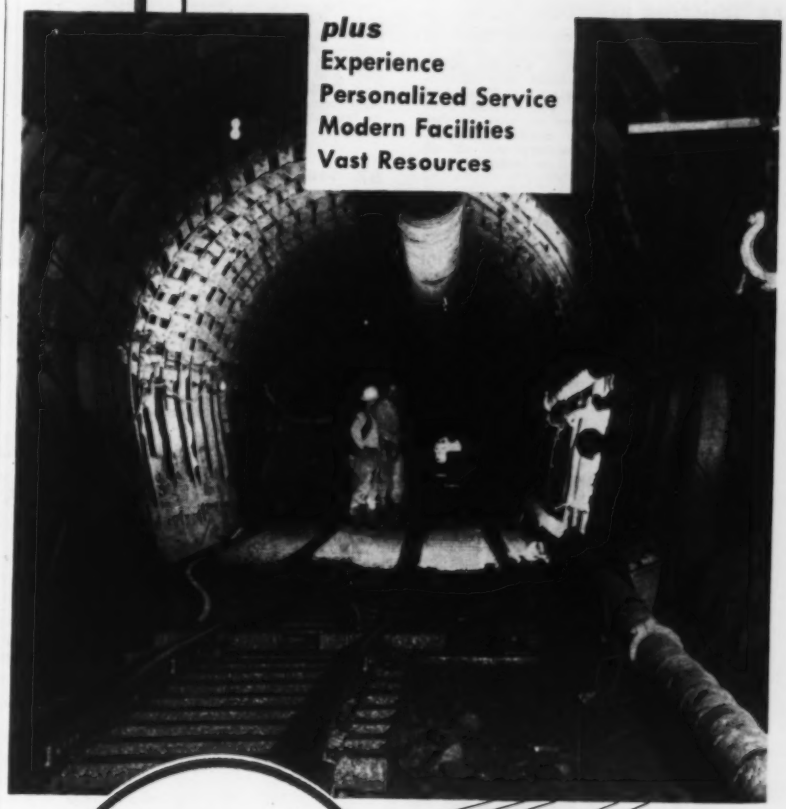

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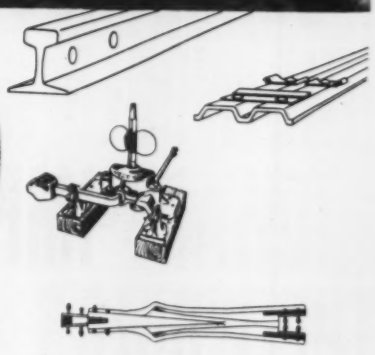

H. K. PORTER COMPANY, INC.
CONNORS STEEL DIVISION

83 FORK TRUCKS

Clark Equipment Co.—An 8-page, 4-color brochure describes the construction, operating characteristics and specifications of all three models in the new "Ranger" line of fork trucks for outdoor handling. Schematic drawings illustrate the torque converter, power-shift transmission, non-steering drive axle and steering drive axle designed especially for the equipment. Sketches describe the new brake system and differential locking device used to distribute power equally to all wheels. Color drawings that indicate some applications of the machines plus tables and charts are included.

84 FORM-TYING HANDBOOK

Richmond Screw Anchor Co.—The latest in concrete form-tying and anchoring methods and devices is described in a 46-page handbook. Strengths, working loads and dimensions, drawings to show their uses, a detailed section of tested form-ty engineering procedures, formulae and tables are also provided. Many aspects of form design and construction including hanging systems, tilt-up construction, etc. are covered by blueprints.

In filling out the coupon, please print clearly and be sure that you furnish a complete address. Please allow at least four weeks to process your requests.

85 FOUNDATION PIPE

L. B. Foster Co.—A new 16-page catalog giving complete technical information on spiralweld foundation pipe is now available. The complete range of sizes and specifications is given, including o. d. sizes, wall thicknesses, weights per lineal foot, section modulus and radius of gyration. Application photographs show use of pipe for piling. Typical driving logs and information on driving accessories are included.

86 FRICTION MATERIALS

Caterpillar Tractor Co.—An 8-page illustrated booklet, that answers questions about friction material in clutch facings and brake linings, points out vital characteristics friction materials must have in order to withstand the severe conditions imposed by earth-moving machines. Friction loss, glazing and chipping, wear and torque capacity are discussed. "Friction Facts" describes the tests Cat friction materials must pass before approved for use in tractors or in replacement parts for older models.

87 GEAR DRIVE

Johnson Gear & Mfg. Co.—New literature is available which completely describes and illustrates, through diagrams and photographs, the many features and uses of the Johnson Right Angle Gear Drive. Complete specifications are also given.

88 GEARS

The Earle Gear and Machinery Company—A twenty-page catalog describes in general, the kinds and sizes of gears manufactured by this company. Its contents deal with spur gears, bevel gears, helical gears, worm gears, racks, non-metallic gears, sheaves, sprockets, special machinery of which gears form a part, and special gear information. Illustrated with photographs, it also shows actual Earle installations.

89 GRATING FLOORING AND TREADS

Irving Subway Grating Co., Inc.—General Grating Catalog F400 contains illustrations, descriptions and complete engineering data on grating flooring, treads and floor armoring (riveted, press-locked, welded types). Irving Grating is safe, durable, fireproof, ventilating, clean and economical for industrial and power plants and refinery walkways, stairways, driveways, trucking aisles.

90 GRATINGS

Borden Metal Products Co.—A new 16-page catalog shows the three basic types of grating construction; more than 30 dimensional drawings of subtypes; eight safeload tables covering steel and aluminum gratings, roadway grating and sidewalk slabs plus other tables on panel widths, tread widths, floor armor, etc. Also shown are the various safety treads and their nosings. Included are the steps for careful planning and checking of the job.

91 GUARD RAIL

Granco Steel Products Co.—A new product manual contains 8 pages of application photographs, standard drawings, specifications, curving data, installation instructions and facts on non-highway use of the new Granco deep beam guard rail for highways and bridges. Corrugated from tough carbon steel to act as a continuous impact-resistant beam, its inherent characteristics and engineered features provide hi-strength visual barrier, greater safety, no pocketing, interchangeable sections and economy.

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92 GUNITE

Pressure Concrete Co.—Gunite in all phases is described and illustrated in a 48-page booklet which contains complete specifications. Illustrations show Gunite repair of reservoirs, dams, filter plants, sewage disposal plants, stadiums, bridges, stacks and bunkers. The booklet also contains photographs on new prestressed tank construction and other data. A new leaflet just published illustrates pressure grouting to dams.

93 HEAVY DUTY TRAILERS

Birmingham Mfg. Co.—Catalog "E" fully describes and illustrates a complete line of heavy duty trailers including platform, oilfield and telescopic types as well as tandem and single axle lowbeds. Complete specifications are given in the 25-page brochure and many diagrams and charts are used in the explanation of equipment features.

94 HIGHWAY GUARD RAILS

United Steel Fabricators, Inc.—A new bulletin gives complete information on 2 beam-type highway guard rails: Barrier-Beam, featuring extra-deep corrugations for high impact resistance, exclusive rounded safety-top edge and off-post splicing to permit faster erection; Universal Beam, available in either 10 or 12 guage with wide lap joints that assure high beam strength.

95 HIGHWAY PAVING

Barber-Greene Co.—Among the many features of the Model No. 879-B finisher are positive traction, new transmission, higher-speed tamper, new crawlers and new power unit. The new finisher is the subject of a 12-page booklet which is fully illustrated.

96 HORIZONTAL SHORING

Spanall of the Americas, Inc.—Now available is a revised edition of the 8-page catalog on the subject of Spanall, registered trade name of pre-stressed, all-metal horizontal shoring for all types of beam and slab concrete floor forms. The new catalog contains complete engineering and application data, supported by isometric drawings, charts and photographs illustrating typical installation techniques.

97 HOT-MIX ASPHALT MIXING

The Asphalt Institute—"Specifications and Contruction Methods for Hot-Mix Asphalt Paving" brings together in a concise and logical relationship all recognized and proven types of hot-mix asphalt paving. By following the specifications and construction methods outlined in this 96-page booklet, the engineer will be able to prepare specifications that may include special characteristics of physical dimension, quality, and financial investment according to local requirements and limitations. The price is $.35.

N. B. There is a charge for this book. Make checks payable to The Asphalt Institute.

98 HOT-MIX ASPHALT PAVING

The Asphalt Institute—"Mix Designs for Hot-Mix Asphalt Paving" outlines in detail four mix design methods: the Marshall; the Hveem; the Hubbard-Field; the Smith Triaxial. This manual is for the construction and guidance of inspectors and technicians activeiy engaged in the design of hot-mix asphalt paving and for student instruction in this specialized field of engineering. The price is $1.00.

N. B. There is a charge for this book. Make checks payable to The Asphalt Institute.

99 HOW TO CORE DRILL

Acker Drill Co., Inc.—"Basic Procedures of Diamond and Shot Core Drilling" shows with over 80 illustrations and drawings the fundamentals of core drilling practice. Pipe driving, core recovery, core logging and storage are all covered in this pocket size book for the beginning driller. The price is $1.00.

N. B. There is a charge for this book. Make checks payable to Acker Drill Co., Inc.

100 HYDRAULIC DATA BOOK

Leupold & Stevens Instruments, Inc.—Interpretative data on water measurement and control is at your fingtertips in this 144-page revised edition, in three parts: float wells and instrument shelters; errors in flat operated devices; hydraulic tables; plus pages for notes and memorandums. Indispensable for the engineer with its wealth of information, tables and illustrations, the price of the book is $1.00.

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101 HYDRAULIC TESTING MACHINE

Soiltest, Inc.—A 2-page bulletin describes the new Versa-Tester, a hydraulic testing machine with capacities to 30,000-lb. Compression and tension tests that can be run and materials that can be tested are listed in the illustrated bulletin. Specification and accessory descriptions are included.

102 HYDRAULIC TURBINES

The James Leffel & Co.—Details on the turbines which drive both power generation and pumping units at the United States Bureau of Reclamation, Chandler Pow and Pumping Plant, are given in a 12-page Bulletin 1098-E. Descriptive literature on other recent turbine installations will be inclosed.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

103 IH TD-24 MAILER

International Harvester Co.—An 8-page pamphlet, "Boss of the Big Jobs," emphasizes the solid framework of the 200-hp TD-24, its planet power steering, and the option of torque converter or gear drives. Line drawings illustrate components of the torque converter, drive system, the main frame, and a cutaway exposure and explanation of the planet power steering system.

104 INDUSTRIAL HISTORY

Graver Tank & Mfg. Co.—To celebrate its Centennial, Graver has issued an interesting folder on the company's history. Called "A Century of Craftsmanship in Steel and Alloy," it presents an excellent summary of the last 100 years of industrial history centered about the techniques and contributions of a leading fabricator.

105 JETTING PUMPS

Griffin Wellpoint Corporation—A booklet illustrates jetting pumps for pile and caisson jetting, oil pipe line testing, water supply and fire protection. The illustrations show unusual set-ups for high-pressure jetting, including parallel and series pumping arrangements.

106 JOBS DESCRIBED

Boeing Airplane Company—An extensive brochure is offered describing the roles of aeronautical, civil, electrical and mechanical engineers, mathematicians and physicists in the design, research and production of advanced commercial and military aircraft and guided missiles at this company. Home address requested.

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CATALOG DIGESTS

107 JOINT SEALER AND WATERSTOP

Sika Chemical Corp.—A brochure describes the four new consistencies of Igas Joint Sealer. The stiffer consistencies are used for water reservoirs, swimming pools, tunnels and deep basements. Lighter consistencies are used where there is no actual water pressure such as joints in metal building panels. Specifications and architectural details are included.

108 JOINTS FOR VITRIFIED CLAY PIPES

National Clay Pipe Mfg.—Five tested methods for joining vitrified clay pipe are described in a new bulletin now offered. This 2-color, 4-page bulletin gives instruction for jointing hot-poured bituminous, plastisol, pre-cast bituminous, mortar, and pressure joints. Information on preparing trench beds and backfiling is also included.

109 K-45 KOMPACTOR

Buffalo-Springfield Roller Company—An illustrated 8-page colored booklet giving complete specifications and on-the-job performance reports of the K-45 Kompactor. The time saving, cost cutting Kompactor is self-propelled, highly maneuverable. Works on steep banks and all but eliminates hand-tamping. Features exclusive compaction principle.

PLEASE PRINT
NAME CLEARLY.

110 LAND CLEARING EQUIPMENT

Fleco Corp.—Equipment designed to multiply the usefulness and step up the capacity of cat track-type tractors is the subject of a new fully illustrated brochure. Included are front-mounted equipment such as a treedozer, rock rake and root rake; equipment for use on drawbar or tool bar such as a pull stumper, rolling chopper, and undercutter.

111 LATEX BINDER

Surco International Corp.—Surco, a modified latex emulsion which imparts to cementitious materials exceptional tensile strength, density, watertightness, resilience, resistance to wear and temperature changes, protection against certain corrosive agents, is described in a new 4-page bulletin. The bulletin also clearly outlines the general specifications and many uses of this new product.

112 LEVEL READING

Lenker Mfg. Co.—A new 4-page bulletin describes endless band direct reading, a new approach to fast accurate leveling. Methods of setting the band at the bench mark and measuring elevations are discussed.

113 LIMI-TORQUE CONTROL

Philadelphia Gear Works—28-page catalog L-550, gives background information on this automatic, power activated device for controlling all types of valves and sluice gates. It describes the available types and lists specific applications. Installations are shown in power plants, refineries, and in various industries.

114 LONGSPAN JOISTS

Haven-Busch Co.—A 32-page catalog describing the new longspan series joists SJI-AISC and includes Top Chord Extension graphs, maximum moment table, load-carrying tables, panel dimensions, and other pertinent design data.

115 LOW-BED TRAILER

Dorsey Trailers, Inc.—A new low-bed trailer with removable gooseneck has been added to Dorsey's line of machinery trailers. Available in capacities of 15 to 75-tons, the trailer simplifies one-man loading and unloading of heavy machinery. A hydraulic system lowers the front end to the ground, and lifts it back into running position. Detailed information is available.

116 MAPPING PRODUCTS

Fairchild Aerial Surveys, Inc.—A quick reference guide to Fairchild mapping products shows the materials and methods for producing different types of maps. Included are oblique and vertical photos, photo index and line index, controlled mosaic or photomap, topographic contour map, magnetic contour map, and radioactivity contour maps and strip chart.

117 MASONRY DRILLS

Termite Drills, Inc.—A recent catalog describes the complete line of Termite Carbide Tipped Rotary Masonry Drills. These drills feature nitride hardening which extends drill worm life at least 500 percent over drills that are not hardened. Prices and drilling recommendations are given.

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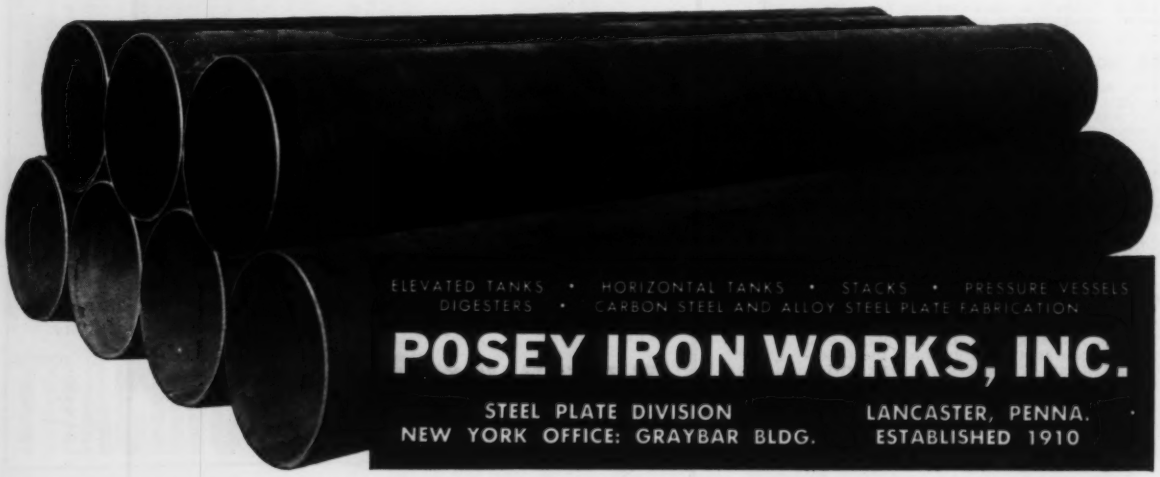

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HYDRAULICS TRANSLATIONS

To avoid duplication of effort and to bring the hydraulics engineer a definitive list of available translations of literature on hydraulics, the Committee on Research of the Hydraulics Division has prepared "A List of Translations of Foreign Literature on Hydraulics." This material is available as ASCE Manual 35—the latest of a renowned series of authoritative publications on civil-engineering subjects. This Manual can be ordered by clipping this coupon and remitting as indicated below.

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ARCH DAM SYMPOSIUM, JUNE, 1956

Since the last symposium on masonry dams was held in April, 1939, much progress has been made in the design and construction of arch dams and their appurtenances. This symposium was planned to enable engineers concerned with arch dams to exchange their ideas and experiences for the benefit of all. A single volume containing the papers from this symposium is now available from Colorado State University. This volume can be ordered by clipping this coupon and remitting as follows: In quantities of 50 or more the cost is $3.50 each; for orders of less than 50 the cost is $5.00 each.

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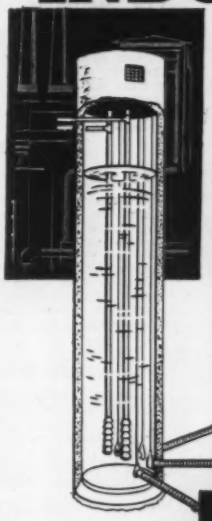
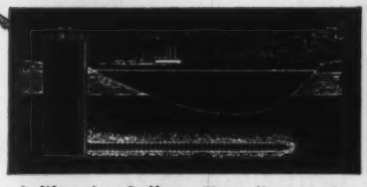


Conventional Collector. Proven by industries the world over, the collector that yields more naturally filtered water, with less equipment, less personnel, and fewer pumps than any other conventional collector.



Infiltration Gallery. The gallery, engineered by Ranney, provides industry a low cost water supply. The gallery provides large quantities of clear non-turbid water in a revolutionary yet economical way, and it requires no maintenance.

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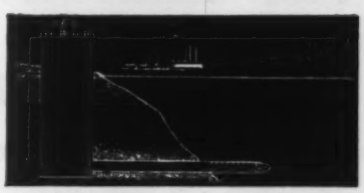
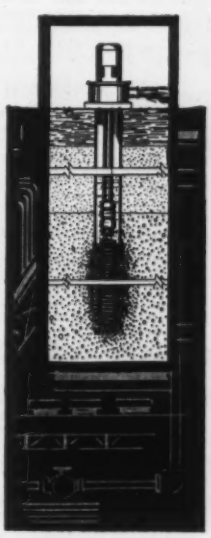


Ranney Intake. The Ranney Intake, already has proven that plants and factories can obtain surface water both efficiently and economically. The Ranney Intake can usually fit into the design of your engineering department or consultant.



Ranney Vertube. Small industry and low volume users can now have a natural gravel vertical water well at low cost. Engineered with the same Ranney precision that has made their method a *must* for industry.

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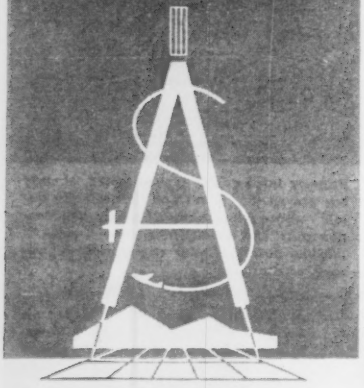

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CATALOG DIGESTS

118 MATERIALS

Vulcan Materials Co.—The 1956 Annual Report contains informative descriptions of Vulcan products, which include concrete, aggregates, chemicals, metallics, plastics, and paving materials. Vulcan's slag, a by-product of blast furnaces and described as one of the best and most versatile aggregate materials, is highlighted in the 28-page booklet.

119 MEASURING FLUMES

Thompson Pipe & Steel Co.—Four pages of tables on Free-Flow discharge for Parshall Measuring Flumes up to 20-ft throat width are included in the catalog describing this all-steel product which provides accurate measurement of water and fluids in open channels and ditches for irrigation systems, water works, sewage and industrial plants. They are also made of stainless steel and aluminum.

120 METERS, FEEDERS, CONTROLS

B-I-F Industries, Inc.—A new catalog provides a general coverage of equipment made by this company and its divisions. Photos of equipment as well as installation photos and brief descriptions of many products including flow, level, and pressure or temperature meters, liquid and dry material blenders, diatomaceous earth filters, liquid and dry feeders, control equipment and apparatus, and equipment accessories are included.

121 METRIC WALL CHART

Mayo Tunnel and Mine Equipment—Simplified metric conversions, originally designed for the Mayo company office is now available. Newly revised chart includes: feet to meters; inches to meters; decimals of a foot; meters to feet plus other useful conversion factors. Illustrated are steel forms, tunnel shields, grouters and other equipment for the mining industry.

122 MINING EQUIPMENT

Caterpillar Tractor Co.—"Modern Mining," an illustrated catalog of modern, heavy-duty machinery in today's mine, shows how Cat's crawlers, wheel tractors, tractor-shovels and motor-graders help increase production in many ways. From bulldozing and ripping overburden to primary power and hauling, actual job reports and on-the-spot photos explain the versatility of these units. The booklet also lists condensed data on some recent units.

123 MOBILE COMMUNICATION SYSTEMS

Bendix Radio—Equipment to provide 2-way FM communication with mobile units are described and illustrated in a 6-page brochure. A description of typical installations as well as complete specifications and typical performance data are included.

124 MOLOX BALL JOINT PIPE

American Cast Iron Pipe Company—New illustrated catalog contains instructions for assembly, weight and dimension tables and different methods of installing Molox Ball Joint Pipe for river crossings and submarine service.

125 MOTOR GRADER

Allis-Chalmers Co.—Working advantages provided by the Model Forty Five Motor Grader are covered in a new 16-page, 2-color catalog. Photographs, sketches and other instructive illustrations aid readers to visualize details of the motor scraper's mechanical features and components. On-the-job photographs further assist in telling the performance, operating, comfort and service simplicity of the Forty Five. The catalog also tells about attachments and accessories that add to the versatility of the unit, and includes its specifications.

Turn to page 136 and order your literature.

TIDE GATES

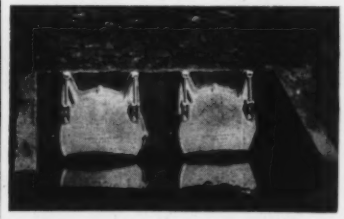

Fig. B-124-D
Two 60″ Type M Gates on Relief Culverts near Woodward Pumping Station, Plymouth, Pa.

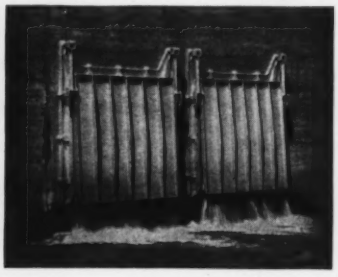

Fig. B-124-C
Two 72″ x 72″ Type M-M Gates on Toby Creek Outlet Works, Plymouth, Pa.

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The world's finest low-cost precision testers.

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CATALOG DIGESTS

126 MOTOR GRADER

Galion Iron Works & Mfg. Co.—The Galion T-700 Grade-O-Matic Motor Grader with torque converter and power-shift transmission was built to give maximum push-power at the blade and to prevent useless spinning of the drive wheels. A 4-page illustrated brochure contains a complete description and specifications.

127 MOTOR SCRAPER

Allis-Chalmers Mfg. Co.—Performance and design features of the TS-160 Motor Scraper, recently added to the Allis-Chalmers motor scraper line, are featured in an 8-page illustrated catalog, MS-1226. Photograph's, illustrations, and specifications help tell the new model's design and construction story.

128 NON-CLOG PUMPS

Economy Pump Div., Wheeler Mfg. Co.—A new 4-page catalog describes 2 types of vertical non-clog pumps designed for sewage disposal, underpass service and drainage, and many applications in reduction plants and paper mills. The catalog illustrates 3 different dry pit installations for medium-to-deep settings. Metallurgy, performance data and size information, as well as photographs and cutaway drawings are included.

129 NON-SHRINK MORTAR

The Master Builders Co.—How to get better results in 12 important construction operations by using non-shrink mortar, is discussed in a new bulletin just published. The operations are illustrated in a building cross section view as cover such applications as waterproofing walls and joints, grouting building columns, machinery and anchor bolts, to caulking sewer pipe joints, etc. Each application illustrated is keyed to a short explanatory paragraph.

130 NON-SKID GRATING

Reliance Steel Products Co.—A new catalog on Relgrit abrasive embedded surface non-skid grating gives details of application, design and illustrations of typical installations. Catalog R-655B includes technical information, available grating sizes, safe load tables, and tread sizes and details.

131 OILLESS LUBRICATION

Spadone-Alfa Corp.—Literature providing complete information about Metaline, a non-graphite compound that is premolded for superior density and long life, is now available. Metaline oilless self-lubricating bushings, expansion plates, washers and special parts are described. This exclusive lubricant assures long service in underwater, high temperature, heavy load and corrosive applications.

132 OPPORTUNITIES IN ENGINEERING

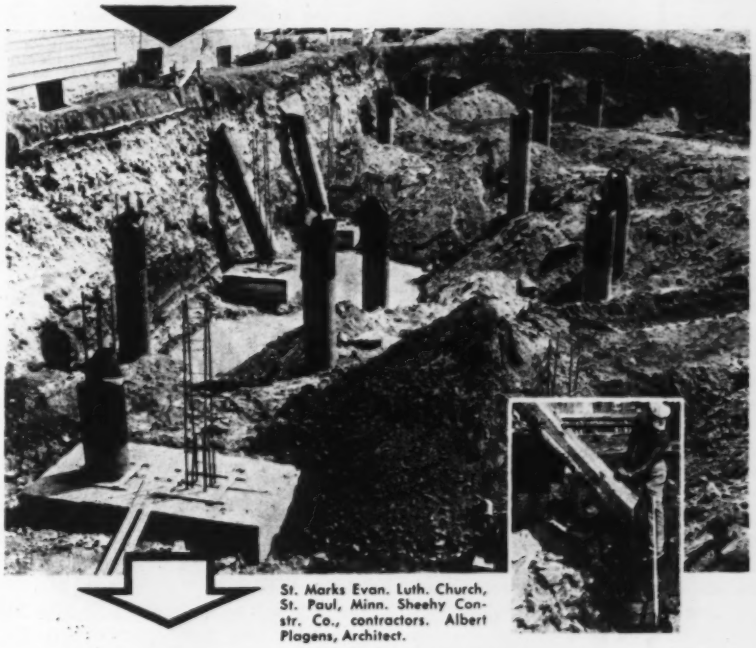
Northrop Aircraft, Inc.—An informative brochure describing the many engineering opportunities in such projects as inertial and celestial guidance, boundary layer research and others associated with the Snark intercontinental guided missile and the new T-38 supersonic jet trainer, is now available. The excellent working conditions in Northrop's new multi-million dollar engineering and science center, the benefits of working with Northrop, and the advantages of Southern California living are vividly explained in this free booklet.

133 OPTICAL TRANSIT

Geo-Optic Co., Inc.—An optical transit with erecting eyepiece, double center, T 50, represents a new low priced precision instrument enabling surveyors, engineers, etc., to cope with any possible problem of triangulation and to obtain results of the highest accuracy. A leaflet explaining this new type of theodolite is available.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME!

Backfilling
before pouring concrete
saves time and money



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Concrete column underpinning formed with

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The footings for the round columns of reinforced concrete were set well below grade.

The use of low-cost Sonoco SONOTUBE Fibre Forms for the underpinning made backfilling possible before pouring because stripping and recovery of forms was unnecessary. The fibre forms required no bracing as backfill held them in place.

Ready-mix trucks moved on the fill to pour the columns. Backfilling before pouring resulted in the use of less equipment, labor and materials . . . and stepped up construction time.

For a fast, economical method of forming round columns of concrete, use Sonoco SONOTUBE® Fibre Forms! Sizes from 2" to 48" I.D. up to 48' long. Order in specified lengths or saw to your requirements on the job. See our catalog in Sweets.

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134 PAVING HANDBOOK

American Bitumuls & Asphalt Co.—The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials. These include road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, with condensed Asphalt Institute specifications. Also, there is data on Laykold compounded asphalts for flooring, tennis courts, and protective coatings.

135 PAVING PRODUCTS CATALOG

W. R. Meadows, Inc.—A new catalog on Sealtight Paving Products . . . covering asphalt expansion joints, corkfill expansion joints, fibre expansion joints, center strip, dummy joints, concrete curing compounds, subgrade paper, base plate, rubber asphalt joint seal, sewer joint compounds and road marking paints is offered. The catalog not only contains all of the general information on each product, but also a Standard Specifications section that truly explains what specifications each product meets.

136 PILE DRIVING

C. L. Guild Construction Co., Inc.—A new eight-page brochure entitled "Pile Driving" includes a fairly comprehensive brief on piles and pile driving. This literature also describes in great detail the Cobi Cast-in-Place Concrete Pile, gives specifications and the method of installation. The brochure is amply illustrated with action photographs and various completed structures which rest on Cobi piles. Included also are detailed examples of recent load tests made on Cobi Cast-in-Place Concrete Piles.

WATER CONVEYANCE ...is a modern art

Water always has been vitally important to Man. Ancient camps and cities always were located near water. Yet, conveyance of large quantities of water by pipe lines, pumps and valves for domestic consumption, industrial supply and fire protection, is comparatively a modern art. Only 100 years ago in this country, crude pipes and valves made of bored logs were in common use.

Compare the wooden valve body with its crude iron-paddle gate used in Mobile, Alabama, 1840-1850, with the modern M&H mechanical joint valve above. M & H valves and hydrants today are engineered products, made to conform to exacting standard specifications. That's why leading water works engineers today use M & H valves and hydrants.

For complete information, address

M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH

137 PILE REPAIR

Masonry Resurfacing & Construction Co., Inc.—An eight-page illustrated pamphlet is offered describing the Dri-Por system of pile repair and encasement. The pamphlet describes the application of the Dri-Por system to the repair of the 5-mi James River Bridge system near Newport News, Va. Also included is a description of the Dri-Por K-box which allows repair of concrete piling in the dry, and high quality repair for wood and steel.

138 PILES

Raymond Concrete Pile Company—Standard and step-tapered piles are described in Catalog S-57 which also includes information on the scope of Raymond's activities covering every recognized type of pile foundation. Domestic operations include harbor and waterfront construction, and cement-mortar lining of pipelines in place. Ryamond's services abroad also include all types of general construction.

139 PILES

The Union Metal Mfg. Co.—Catalog No. 81 on Monotube piles, in addition to general descriptive information, contains engineering data covering physical properties, specification suggestions and test loading; also, contractor data on concrete volumes and weights. It includes numerous photos showing a wide range of job applications throughout the country. Advantages listed: light weight, easy handling, economical field extendability, visual inspection after driving, highload carrying capacity with extra high economy per ton load supported.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

140 PIPE CLEANING EQUIPMENT

Miller Sewer Rod Co.—Free catalog lists information and prices on all types of electric and hand pipe cleaning equipment for cleaning out clogged-up toilets, wash basins, urinals, floor drains, sewers from 3 to 12-in., up to 500-ft in length. Units listed are said to remove roots, grease, rags, sand, glass and obstructions. Helpful advice states how you can save costly plumbing bills.

141 PIPE COATINGS

Vulcan Materials Co.—Teckote, a protective coating for concrete pipe, is the subject of a new 6-page brochure. The manufacturer assures "life insurance" for concrete industrial and sewage lines with the use of Teckote-100. The brochure outlines tests which have been made of the new product. The text is further amplified with photographs, charts, tables and specifications.

142 PIPELINE EQUIPMENT

Caterpillar Tractor Co.—Titled "Pipelining," a 2-color, 8-page, fully illustrated brochure deals with a complete line of pipelayers and hydraulic pipelaying attachments. The use of Caterpillar Diesel Engines as power units for such pipeline equipment as ditchers and arc-welders is also explained. Two new pipeline tools, the D9-mounted Kelly Ripper and tractor-mounted welder, are also explained in terms of their savings to the contractor. Complete specifications are given along with detailed explanations of many of their operational features.

143 PIPE PASSAGE PROCESS

American-Marietta Co.—A new pamphlet contains many photos showing how the Tunneliner Process allows quick passage of elliptical pipe through pipe underground without disruption of surface traffic. New "2-way" Tunnelugger illustrates how one man can operate in either direction from a centrally located shaft to quickly deliver and position Inner Circles at either end while digging continues at the other. Discharge graphs and a diagram of hydraulic properties are also given on Inner Circles.

CATALOG DIGESTS

144 PNEUMATIC TIRE FORK TRUCK

Clark Equipment Co.—Specifications, operating characteristics and design features of the Clarklift Y-200, a pneumatic tire fork truck of 20,000-lb capacity designed for heavy-duty outside handling, are contained in a 6-page brochure. Drawings indicate dimensional characteristics and turning radius. Included are charts giving drawbar pull capacity and upright dimensions. All major components are described. Action photographs illustrate applications.

145 PNEUMATIC TIRE ROLLER

Bros, Inc.—An illustrated, 4-page brochure shows the full line of Bros pneumatic tire rollers. It shows these rollers in action of four different applications. A worm's-eye-view clearly illustrates how the wide face tires give full coverage with each pass. Diagrams also show the principle of rubber tire compaction with oscillating axles, and the special compaction advantages of exclusive wobble-wheel rolling.

146 POCKET TRANSIT

Wm. Ainsworth & Sons, Inc.—A new booklet shows how Brunton Pocket Transit is used as a compass, transit, level, plumb, alidade and clinometer. The transit shows direction to 1-deg; level, slope or grade within 1-deg; weighs only 9-oz. Its size is 2¾-in. by 3-in. by 1⅛-in.

147 POLYVINYL-CHLORIDE PIPE

L. B. Foster Co.—Advantages of the new PVC pipe for applications requiring pipe with light weight, rigidity, and resistance to chemical action and weathering are described in a new 4-page brochure. PVC pipe is identical in IPS size to steel pipe and can be threaded on standard pipe dies. Photographs show some applications.

148 PORTABLE GASOLINE RAMMER

Barco Manufacturing Company—Offers an eight-page catalog describing the Barco portable gasoline rammer for soil compaction. This tool is the only successful mechanical means of obtaining specified soil compaction in restricted areas such as in trenches and near walls and bridge abutments. It is easy to operate, safe, and will compact 20 to 30 cubic yards of fill per hour where high degree compaction is specified. Barco also offers a bulletin "Cost Data for Soil Compaction in Restricted Areas with the Barco Rammer" of interest to all earthmoving contractors.

149 POWER HOUSES

Ingalls Iron Works Co.—A new 36-page booklet illustrates numerous power houses and plants fabricated and erected by Ingalls, a major fabricator of structural steel and plate work for power houses.

150 PRECAST CONCRETE BRIDGE MEMBERS

American-Marietta Co.—A new 8-page folder shows how Amdek prestressed, pretensioned concrete spans revolutionize bridge construction methods. It also illustrates skew beam tests, load distribution tests and tests to destruction being conducted in independent laboratories.

151 PRECIPITATOR

The Permutit Company—Bulletin N.O. 2204 is a well-illustrated and documented 20-page pamphlet describing the many applications, principles of operation, design features, advantages, recommendations, flow diagrams and specifications of Permutit's precipitator. The precipitator offers, through its three basic designs, an efficient means of removing impurities from a liquid by precipitation, absorption, settling and filtration. Chief uses are in water softening, the reduction of alkalinity and the removal of turbidity, color, taste, odor, silica and fluoride.

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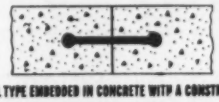
How to Choose Waterstop for optimum performance in concrete joints

Basic Design And Resilience Most Important Factors

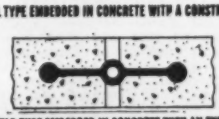
The principal function of waterstop is to keep concrete joints watertight where hydrostatic water pressure is present. To be effective, and to perform its function under widely varying conditions, the waterstop must:

1. **Be designed in such a way that it will maintain a "pressure seal" when the joint is opened up or compressed, or when hydrostatic pressure is exerted against it.**
2. **Be made of a material that is inherently stable and resilient...that will retain its resiliency and strength under wide ranges of temperature.**

There is general agreement by many governmental and private specifying authorities, after years of testing and actual installation, that the dumbbell design of waterstop (below) is mechanically superior to any which has been developed to date. The design provides a self-sealing action, because as the concrete contracts and the joint opens up, the outer edges of the dumbbell bulbs become more tightly engaged with the concrete, insuring a tighter seal as the tension increases, due to movement either in the joint or increasing water pressure on one side of the joint. In effect, the greater the longitudinal pull or pressure on one side, the more tightly the dumbbell ends are pulled and squeezed against the concrete. The simpler dumbbell design of the rubber waterstop allows full strength and contact with the concrete surrounding the waterstop. The larger design also provides for maximum strength to resist higher pressures on the web of the waterstop across the joint opening.



6" DUMBBELL TYPE EMBEDDED IN CONCRETE WITH A CONSTRUCTION JOINT



6" HOLLOW BULB TYPE EMBEDDED IN CONCRETE WITH AN EXPANSION JOINT

Rubber and vinyl are the most commonly used waterstop materials. For the majority of applications, rubber is the most satisfactory material. Being a thermosetting material, rubber is more resilient and "live"...will maintain a constant pull against the retaining edges (bulbs) as the joint opens up or water pressure increases. Vinyl is a thermoplastic compound and tends to take a "set" after it has been stretched, will float in the joint cavity, and have less resistance to the passage of water. When higher temperatures are present, such as in oil storage tanks, where oil is kept at temperatures around 150°F., the vinyl material, unless specifications are rigidly written, will soften and lose strength, causing a failure of the waterstop.

Field Splicing of Dumbbell Type

Servicised Products Corporation has developed a new Union which provides a simple method of joining the ends of dumbbell waterstops, making it just as fast and easy to field splice rubber and neoprene waterstop as the joining of the polyvinylchloride types.

The Union is made in the same cross-section, and from the same material as the waterstop. It is hollow, except for a solid web at the center. After adhesive is applied to the waterstop ends, they are inserted in the Union and pushed against the centering web. The splice is then clamped together until the adhesive has set. This completes the splice.

Dumbbell type rubber and neoprene waterstop are fully described in a special Waterstop Circular available from Servicised Products Corporation upon request. The Union and an interesting new development, Split Type, are also illustrated and described in the circular. Write for it today.

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6051 W. 65th Street, Chicago 38, Illinois

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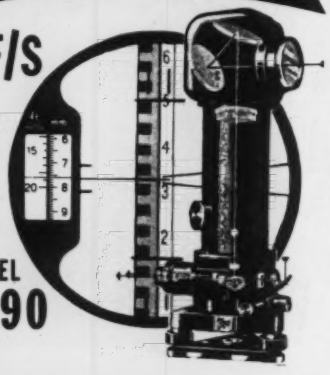

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CATALOG DIGESTS

152 PRECISION INSTRUMENTS

C. L. Berger & Sons, Inc.—"Solar Emphermeris and Polaris Tables," 1958 Edition, 96 pages, contains complete instructions for determining azimuths from the sun and the altitude of Polaris, has been prepared by Herman J. Shea, formerly Associate Professor of Surveying, Massachusetts Institute of Technology. Directions for making astronomical observations and computing results by direct solar observation and time from same observation: meridian by solar attachment; meridian by Polaris at elongation; azimuth by Polaris at any hour angle; latitude by sun at noon, and latitude by Polaris are included. Price is $.50 per copy.

N. B. There is a charge for this book. Make checks payable to C. L. Berger & Sons, Inc.

153 PRECISION TRANSIT

Warren-Knight Co.—A new full page folder illustrating, describing, and explaining the 29 special features of the latest model, medium size, medium weight Precision Transits, Series 7 and 9, has just been issued. This new series Transits have many exclusive features which assure accuracy, ease, speed and convenience in handling, sturdiness, and a minimum of maintenance and repair cost. Price List is available without charge.

154 PREFABRICATED ASPHALT LININGS

Gulf Seal Corp.—A leader in the field of seepage control reports on the experiences of cities and industries in seepage proofing a wide variety of structures, ranging from municipal drinking water reservoirs, industrial salt water storage pits, large irrigation canals, and industrial waterways of every kind. Complete details of these projects plus comprehensive data on the material itself are included in an engineering brochure.

155 PRESTRESSED CONCRETE EQUIPMENT

Intercontinental Equipment Co., Inc.—The Prestressed Concrete Division has available a complete line of hydraulic pumps, jacks and accessories for the prestressed concrete industry. Pumps are either electric, gasoline, air or hand operated with pressures to 10,000-psi. Jacks are of the pull or push type, spring or hydraulic return. Special center hole jacks as well as threaded rams are also available. Information is given in a new catalog.

156 PRESTRESSED CONCRETE PILES

Raymond Concrete Pile Co.—A newly issued catalog describes and illustrates Raymond cylinder piles of prestressed concrete. Information is given on the merits of prestressed concrete piles for foundations of bridges, waterfront and offshore structures. Shown are many examples of installations and suggested designs.

157 PRESTRESSED CONCRETE TANKS

Preload Co.—"The Design of Preload Tanks," a new 8-page booklet, discusses design requirements, walls, floors, roofs, etc. It features a detailed presentation for a typical 5,000,000-gal tank or similar circular structure, complete with formulae and diagrams.

158 PRE-TENSIONED BONDED PRESTRESSED CONCRETE

John A. Roebling's Sons Corp.—newest booklet on the application and production of this relatively new construction medium. One section is devoted to the details and operation of casting beds. Another section gives engineering data for tensioning strands. Another shows many typical structures as well as some new developments in this field.

159 PROTECTIVE COATINGS

Amercoat Corp.—Services, which are available at no cost and that are part of the Amercoat method of corrosion control, are discussed in a new 4-page, illustrated bulletin. Properties and typical uses, as well as a complete list of chemicals and other materials which can be stored in Amercoat lined tanks, are given.

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Highway maintenance is a year-round operation. Winter, with short days and precipitation, multiplies the safety problem of maintenance as well as highway operations.

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CATALOG DIGESTS

160 PUMPING UNITS

Sprague & Henwood, Inc.—A new bulletin completely describes and illustrates various models of pumping units especially designed for core drilling, soil sampling and pressure grouting.

161 RAILROADING EQUIPMENT

Caterpillar Tractor Co.—Effectiveness of Cat-built machines in railroading is discussed in a new booklet, "For Economical Maintenance of Ways & Structures." Illustrated with on-the-job photos, the booklet shows maintenance under work-a-day and disaster conditions and emphasizes versatility, economy and service availability. A list of equipment and a map of service points along the main lines are also included.

162 REINFORCED CONCRETE PIPE

American-Marietta Co.—This pamphlet covers elliptical Lo-Hed Reinforced Concrete Pipe for culverts and sewers. Specifications are given for the complete range of sizes from the equivalents of round pipe 18-in. I. D. through 144-in. I. D. Illustrations show results of pressure tests and installations of Lo-Hed pipe being made on various types of jobs.

163 REPRODUCTION FILMS

E. I. Du Pont de Nemours & Co.—A colorful, descriptive 6-page folder on Cronaflex engineering reproduction film is now available. This folder clearly and concisely describes the properties and uses of the three Cronaflex films: direct positive; contact; and projection. Cronaflex is a new line of engineering reproduction films developed by Du Pont for the reproduction of drawings, plans and maps. All Cronaflex films are on Du Pont Cronar® polyester photographic film base.

PLEASE PRINT
NAME CLEARLY.

164 REPRODUCTION MATERIALS

Graphic Reproduction Div., Eastman Kodak Co.—"Kodagraph Reproduction Materials" describes all materials available for the reproduction of engineering drawings and documents. Of special convenience to the user of these materials is a two-page materials selection chart designed to help in selecting the film and paper best suited to any job. The original to be reproduced is matched with the equipment to be used in this fully illustrated chart.

165 SANITARY LANDFILL METHODS

Allis-Chalmers—Information on sanitary landfill methods, organization, operation and necessary equipment with which to carry out the job highlights an 8-page market booklet. Photographs of equipment working on landfill and sketches showing how the various landfill methods are developed illustrate the new book.

166 SAWING MACHINE

Concut Sales, Inc.—A new bulletin describes the improved Jointmaster Sawing Machine which is recognized as the most practical and efficient machine for large air base and highway sawing jobs. The machine is equipped with hydraulic drive for easy handling. The saw carriage is raised and lowered hydraulically and it has hydraulic torque converter cross feed. Up-cut action increases blade life. The Jointmaster is available in 12-in. and 24-in. models.

167 SCREENING EQUIPMENT

Link-Belt Co.—The complete Link-Belt line for efficient removal of solids from water, sewage and industrial waste is described in a new 28-page booklet. Dimension and specification data for four types of coarse screens and three types of fine screens, plus tables to determine the proper size unit handling various capacities, are also given.

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regardless of velocity

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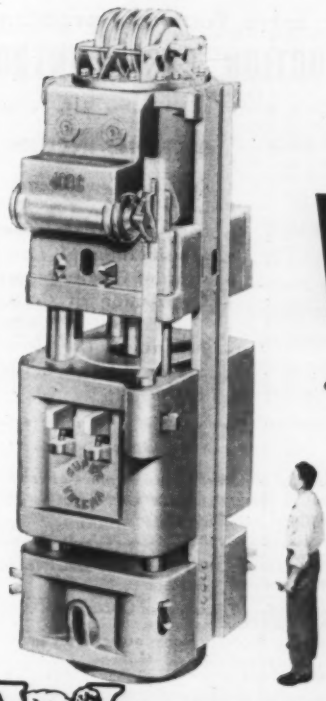

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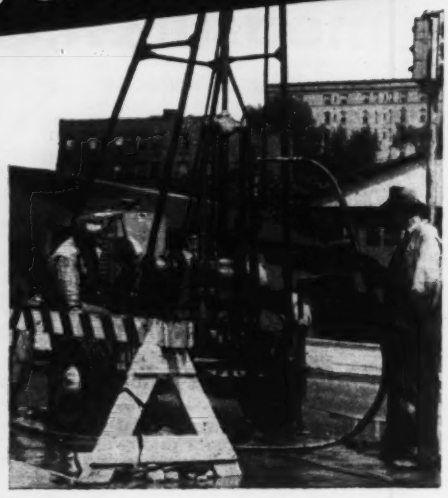

When it's better to be safe than sorry, engineers investigate underground conditions. And, that's exactly what this Acker TH drill is doing — drilling test holes over a walled-up section of the old Erie Canal preparatory to building an overhead express highway.

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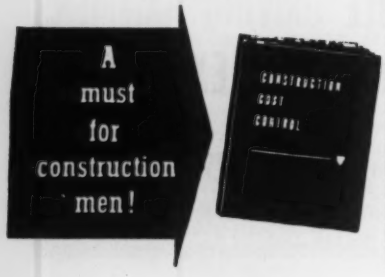

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CATALOG DIGESTS

168 SCREW CONVEYORS

Link-Belt Co.—Many practical suggestions for selection and arrangement of screw conveyor and screw feeder components are contained in 92-page Book 2289. Over 140 photographs and many line drawings show how the screw conveyor is used in handling hundreds of materials.

169 SELF-LUBRICATING BEARINGS

Lubrite Div., Merriman Bros., Inc.—Manual No. 41 is a 20-page book filled with complete information, technical data, and specifications about Self-Lubricating bushings, bearings, and washers for industrial equipment, machinery and Hydro-electric type applications.

170 SELF-PROPELLED ROLLER

Bros, Inc.—A new brochure outlines the special features of the Bros SP-54, 9-ton self-propelled rubber tire roller for mat resurfacing, seal coating and compaction in the standard lift range. It also explains how faster compaction of higher quality is attained with maneuverable Bros Sp-54. Detailed specifications are included.

171 SEWAGE REGULATORS

Brown & Brown, Inc.—manufacture a line of float controlled quadrant gates, in 37 sizes, to automatically control the diversion of sanity flows from combined sewers to interceptors. Such automatic gates may be actuated either from head or tailwaters or dually from two sources. Bulletin 81A contains capacity and dimension charts.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

172 SEWAGE TREATMENT

Dorr-Oliver, Inc.—A 4-page, 2-color bulletin, "The Dorr-Oliver SpiroVortek System," describes the principle of design, operation and advantages of this new development for complete treatment of domestic sewage as well as the equipment units employed in the flowsheet. The SpiroVortex System operates on the same principle as the activated sludge process. It will produce a treated effluent from which over 90% of the raw sewage BOD has been removed. Installation photos, a typical plan flow diagram and a list of installations to date are also included.

173 SEWAGE TREATMENT LINE

Infilco Inc.—Bulletin 80CEC presents complete line of products for the treatment of water, sewage and wastes. Available literature is listed. Indices are provided as a ready reference by class, by trade name, by application. Enumerated is water treating equipment for municipal and industrial use in the fields of municipal water supply, process water for general industry, for power by demineralization, for pulp and paper, for beverage use, and for swimming pool recirculation systems.

174 SHAFT EQUIPMENT

Mayo Tunnel and Mine Equipment—A new 4-page bulletin, No. 20-A, illustrates and describes in detail the Mayo Koepe Hoist system as well as headframes, sinking frames, mine cars, cages, kibbles and gilleys.

175 SHOVEL-CRANES

Link-Belt Speeder Corp.—An 8-page folder, entitled "Shovel-Cranes," describes an advanced line of crawler, truck and self-propelled models of ½ to 3-yd, 8 to 75-ton capacity. The illustrated brochure also discusses Speed-O-Matic, an exclusive hydraulic control feature that is engineered to reduce operator fatigue and to obtain fast, easy, smooth positive response.

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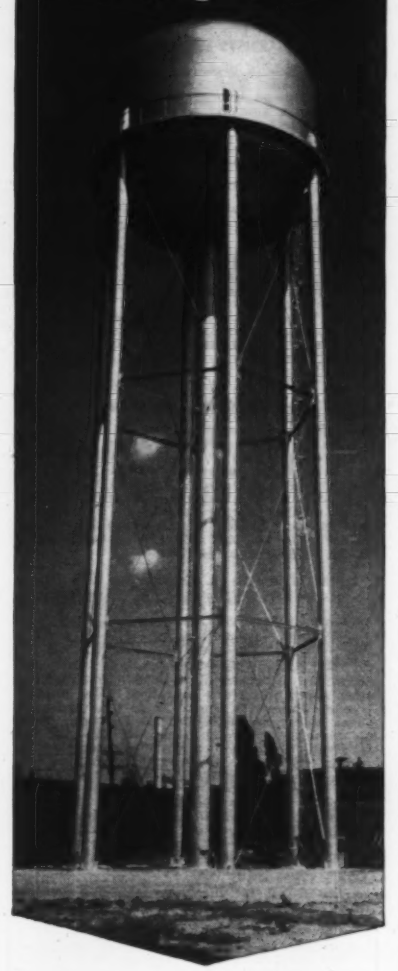

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CATALOG DIGESTS

176 SIEVE SHAKERS

Soiltest, Inc.—A 4-page bulletin, on sieve shakers designed for materials testing and gradation for soils, sand, gravel, aggregates, construction materials, powders, plastics, powdered metals and all types of powdery materials, includes descriptions of grain size determination accessories.

177 SIGN CATALOG

Grimm Stamp and Badge Co.—Featuring a new budget line of silk screened traffic signs, a new 16-page catalog has been expanded to include special signs for industry, parks, associations and highway construction. Contents of the new catalog include all popular U. S. Standard wordings and symbols as prescribed by the Manual on Uniform Traffic Control Devices.

178 SLUDGE BED ENCLOSURES

Metropolitan Greenhouse—All-aluminum sludge bed glass enclosures, that are maintenance-free and superior to wood construction, are described in a new bulletin #656. Scientifically designed, these time-tested and proven alloys assure the ultimate in economy and durability for sludge bed enclosures. Plans, designs and specifications for all purposes are included in the bulletin. Electronic control of ventilation is another feature of this glass enclosure which eliminates many hours used in operating ventilation requirements.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

179 SLUICE GATE

Rodney Hunt Machine Company—The first basic improvement in sluice gates in many years, the patented HY-Q flush bottom closure sluice gate, is described in Catalog 75. The newly released booklet, with 12-pages of illustrations, clearly shows all details of construction, installation, and operation of the unique gate as used in water filtration plants, power plants, municipal and industrial plants, drydocks, and flood control. Diagrams and text explain the many practical advantages offered by the HY-Q gate for water flow control. Complete recommendations for selection of frames and other equipment for sluice gates, as well as detailed specifications, series numbers, and clearance dimensions are also given.

180 SLURRY SEAL

American Bitumuls & Asphalt Co.—"Bitumuls Slurry Seal" is a new operation which consists of mixing fine aggregates with Bitumuls and water to a slurry consistency in a transit mixer, and spreading over the pavement by a specially constructed squeegee type spreader-box. The action of the squeegee forces the slurry into the fine cracks of a weathered but still sound surface of an old asphalt pavement, thereby reducing expensive maintenance patch construction to a minimum.

181 SMALL ENGINEERS LEVEL

Kern Instruments, Inc.—A new brochure describing the OKI Small Engineers Level is now available. The booklet describes the new ideas incorporated into the design of this latest level. Special emphasis has been given to ease of operation, compactness and reliability. The instrument should be of interest to all engineers and surveyors.

182 SOIL COMPACTION

Barco Mfg. Co.—The Vibra-Tamp, a versatile tool for maximum compaction of granular base materials and bituminous surfacing, is the subject of a new 4-page bulletin. Whereas the Rammer covers the cohesive type soils where impact compaction is necessary, the Vibra-Tamp covers the non-cohesive type soils where surface finish is desirable. Specifications and on-the-job photos are included in the brochure.

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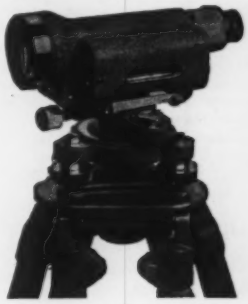

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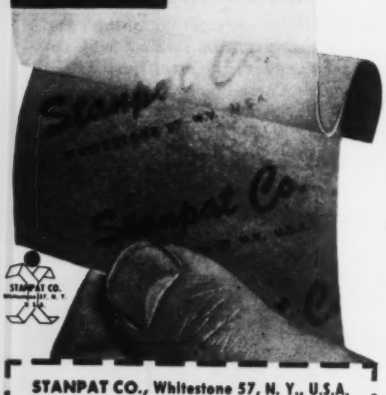

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CATALOG DIGESTS

183 SOIL COMPACTION

Vibroflotation Foundation Company—12-page booklet tells of method to compact loose granular soil to any required depth to 100-ft or more without need of piling or forms for footing. How used and what results can be obtained are described in proven applications for dams, bridges, and any other types of foundations.

184 SOIL SAMPLING EQUIPMENT

Sprague & Henwood, Inc.—The recently completed 24-page soil sampling bulletin includes a wide selection of samplers to fill all soil sampling needs. In addition to the various samplers described in earlier bulletins, it includes the new S & H Vane Shear Tester, the Greer & McClelland Hydraulic Piston Sampler, the S & H Retractable Plug Sampler, and the Harpoon Type Sampler.

185 SOIL SOLIDIFICATION

Manu-Mine Research & Development Co.—"The Science of Soil Solidification" is the title of a new bulletin. Contents include a detailed explanation of what soil solidification is, the methods employed, and solidified soil characteristics. In addition, one section of the brochure deals with the applications of the process to highways, mines, foundations, piers, dams and piling.

Please give your complete address.

186 SPEED REDUCERS

The Earle Gear and Machinery Company—A sixteen-page illustrated catalog, describing speed reducers as applied to operating machinery, particularly bridge machinery, is available. Outlined are specifications service factors, horsepower ratings and dimensions of the particular units illustrated. Gasoline power units are also dealt with in a compact, easy-to-read form. Photographs are shown of actual installations with miniature blueprints included.

187 SPIRALWELD PIPE AND COUPLINGS

Naylor Pipe Co.—Illustrated Bulletin 507 presents story on light-weight pipe for ventilating lines, air and water lines, irrigation pipe, etc. in diameters from 4 to 30-in. Includes standard fittings and welding flanges. Also covers data on one-piece Wedgelock coupling for fast, positive connection.

188 STAINLESS STEEL GRATING

Kerrigan Iron Works, Inc.—A 4-page catalog on stainless steel floor grating-open steel, contains engineering data and safe load table. Weldforged stainless steel grating is rust proof, chemical proof, non-magnetic and has a high heat resistance as well as high corrosion resistance. It is a boon to the chemical, oil and packing industries.

189 STEEL BUILDINGS

United Steel Fabricators—USF's popular line of truss-type steel buildings now includes rigid-frame 30, 40, and 50-ft clear-span designs. Available in 3 eave heights, these new all-steel buildings are widely used for all types of service from simple warehousing to complete plant operations. Both end and side panels come with a variety of door and window arrangements, and exclusive weather-seal corrugations provide strong, leakproof joints. These and other design features are illustrated and explained in a new metal building bulletin.

190 STEEL CONCRETE CASTING FORMS

Food Machinery and Chemical Corp.—A new 20-page bulletin describes the full line of Form-Crete casting forms. Contents include Double T, Bridge Beams, I Beams, Piling and other standard types plus a section showing a number of custom forms that were designed to customer specifications. Each form is illustrated and specifications are described in text and charts.

191 STEEL FOR HIGHWAYS

Bethlehem Steel Company—This 36-page illustrated booklet, "Steel for Highways," describes the broad range of Bethlehem steel products used in the construction of a modern highway. These include reinforcing bars, bar mats, dowel units, structural steel, wire rope, drill steel, pipe, guard rail and posts, fence and fence posts, sheet piling and bearing piles, culvert sheets, rock anchor bolts, etc.

192 STEEL JOISTS

American Bridge Division—This 40-page catalog is the only steel joist catalog containing complete design information for spans up to 120-ft. Such subjects as design calculations, bridging, properties and dimensions, end details and accessories, load tables, marking systems for ordering, and specifications are clearly and completely covered in this catalog.

193 STEEL PLATE CONSTRUCTION

Chicago Bridge & Iron Co.—Methods for high quality steel plate construction by CB&I are described in a new 4-page brochure. Field welding, field X-ray and field stress relieving techniques are discussed. The publication illustrates typical massive structures such as coke drums, catalytic cracking units, a 225-ft diam Hortonsphere, reactor-regenerators, sulphite digesters and accumulators.

194 STEEL RIGID FRAMES MANUAL

Martin P. Korn—Part one presents the fundamentals of analysis and design, including selection of type of frame, derivation of basic equations, and tables of design for single span frames of from 50 to 150 ft. Part two of the volume is a collection of actual designs of a number of structures: an auditorium, bridges, and others. Martin P. Korn is the author. (J. W. Edwards, Inc., Ann Arbor, Mich., 1953. 170 pp., $4.50.)

N. B. There is a charge for this book. Make checks payable to J. W. Edwards, Inc.

195 STEEL SHEET PILING

L. B. Foster Co.—Specifications and descriptive information, helpful in selecting steel sheet piling are contained in a 20-page booklet. Drawings illustrate various types of sheet piling, corners and connections. Data on dimensions, weight and section modulus is given. Diagrams showing construction of several types of cofferdams are also included. For estimating purposes a special table gives lengths of wall formed when using up to 2000 piles in any of 27 types. On-the-job photos illustrate various sheet pile installations.

196 STEEL TAPE COMPASS

Omicron Co.—Literature is available describing Omicron steel tape compasses, which have a capacity of 72-in., but reel up into a few inches space. A trigger locks the beam in any position. The steel beam on the edge assures parallel disposition of scriber and center pin for absolute accuracy. The floating center pin eases positioning. An adapter for inking pen and also special graduation in decimals of feet are available.

197 STRATAGRAPH

Edo Corp.—An illustrated brochure describes the new Model 400 Stratagraph, strata penetrating sonar which records, with sharp definition and complete accuracy, formations underlying rivers, lakes and other relatively shallow bodies of water. Sediment, intermediate layers, bed rock and faults are readily distinguished and pictorially shown on permanent chart. The brochure illustrates equipment and typical recordings.

Turn to page 136 and order your literature.

CATALOG DIGESTS

198 STRUCTURAL ARC WELDING

The Lincoln Electric Company—A continuing series of studies—how arc welding is used in modern structures—is issued periodically. Case histories of welded bridges, buildings and miscellaneous structures: drawings, details and calculations for typical structures are included.

199 STRUCTURAL PADS

Lubrite Div., Merriman Bros, Inc.—Bulletin No. V-10 contains information and technical data on Vibridge structural pads for bridges. This brochure includes charts and graphs on Vibridge, physical properties and other important information.

200 SURVEY DEPTH RECORDER

Edo Corp.—New literature describes and illustrates Model 255 and the new Model 255A Survey depth recorders, with sample recordings. Precision sonar equipment for measuring depth of water (0-250 fathoms) with great accuracy, this compact equipment is readily installed on all types of survey vessels. Model 255A, with narrowed beamwidth, records with exceptional detail in relatively small areas.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

201 SURVEYING INSTRUMENTS

C. L. Berger & Sons, Inc.—A series of descriptive folders illustrating surveying instruments is now available. General characteristics are fully described with essential specifications for each instrument.

202 SURVEYING INSTRUMENTS

Fennel Instrument Corp. of America—Literature is offered containing photographs, as well as detailed descriptions and prices, of the manufacturer's complete line of transits, levels and theodolites for all purposes. Also included is a description of the new planimeter which sets to zero automatically, just by touching a button.

203 SURVEYING INSTRUMENTS

Filotecnica Salmoiraghi—A new general catalog and individual manuals cover use and maintenance of P/S Levels (conventional and self-leveling), Optical Theodolites and other engineering instruments.

204 SURVEYING INSTRUMENTS

W. & L. E. Gurley—The complete line of Gurley surveying and engineering instruments, including transits, levels alidades, are described in the newly-revised edition of Catalog 50. Transits described include the Hell Gate Precise Transit; Standard Precise Transit; Gurley Telescopic Solar Transit; Standard Precise Mining Transit; Optoplane Precise Transit for industrial use; Optical Plummet Transit. Included are cross-sectional drawings of many of the transits.

205 SURVEYING INSTRUMENTS

Kern Instruments, Inc.—A 32-page brochure offers a brief description of the most important instruments manufactured by Kern & Co., Ltd., of Aarau, Switzerland. Fully illustrated, it acts as an index to the detailed literature available on each instrument. Included in the brochure are theodolites, levels, self-reducing tachometers, alidades, pentagonal prisms and many other instruments.

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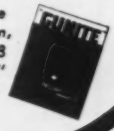

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CATALOG DIGESTS

206 SUSPENSION BRIDGES

John A. Roebling's Sons Corp.—"Bridge Division Products and Engineering Services" a new brainstrom book about the remarkably possible things that can be done with suspension systems. It's greatest single purpose is to show you what is now happening in this field and that these present exciting examples were, not very long ago, just ideas.

207 SWIMMING POOL EQUIPMENT

National Pool Equipment Co.—offers an informative 26-page catalog on complete equipment for new pools and repair of present facilities. This equipment is fully described in the booklet and in many instances detailed so that the designer may choose the equipment to serve the purpose intended.

208 TAMPERS

The Jay Co.—gives detailed information on advantages and uses of Jay Tamping Equipment in all available sizes. A complete list of auxiliary equipment plus the explanatory material is also available. This catalog sheet is compact, complete, well illustrated and very easy to use.

209 TANDEM ROLLERS

Galion Iron Works & Mfg. Co.—Roll-O-Matic Tandem Rollers are the subject of a new fully illustrated folder. Advantages are enumerated: power output automatically increased as needed; more than twice the needed power is available; no master clutch, no gears to shift; up to 25% reduction in fuel consumption. Complete specifications are included.

210 TECHNICAL DATA CATALOG

Lefax Publishers—The 1957 Catalog of Technical Data Books for engineers, technical workers, teachers and students, is now available. Over 2000 subjects are listed, including much newly revised material and technical developments covering every phase of engineering: Architecture, Building Construction, Reinforced Concrete, Surveying Tables, Piping Data, Highway Engineering, Math Tables, Mechanical Drawing and many others.

211 TEMPER-STEEL

Granco Steel Products Co.—Product Manual, BT-571, contains information on new concept in roof design. Tufcor is a deep corrugated tough-temper steel which functions as the structural roof deck. Sheets are furnished with a heavy hot-dip galvanized coating, insuring permanence and maintenance-free construction. Tufcor combined with insulating concrete fill provides a roof deck assembly with many unbeatable characteristics.

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NAME CLEARLY.

212 TENNIS COURTS

American Bitumuls & Asphalt Co.—"Laykold Tennis Courts" is the title of a new 12-page, four-color booklet containing detailed specifications and color photographs of typical installations. There are sections on cost, maintenance, resurfacing and player acceptance. These bituminous courts offer resilient, grit-free, all-weather type surfaces.

213 THE EFFECTS OF CALCIUM CHLORIDE

Solvay Process Division—This is a 40-page booklet which is of interest to architects, engineers and others concerned with specifications, design or production of cement concrete. The booklet contains a variety of tables, graphs and charts dealing with the setting time, early strength, curing, density, surface wear, shrinkage and ultimate strength. Also shown are effects of varying temperatures and cold weather, and the results with special cements including air-entraining, high early strength and low heat cements.

214 THEODOLITE

Geo-Optic Company, Inc.—A leaflet describes the optical universal theodolite Askania Tu with a direct reading of one second and estimation 1/10 second. The Askania Tu Transit enables surveyors to cope with any possible problem of triangulation and to obtain result of the highest accuracy. All readings are done from one position—an important time factor. Other advantages and data are included.

215 THICKNESS DESIGN

The Asphalt Institute—Manual Series No. 1, a 44-page easy-to-handle manual contains information for the determination of the design thickness of flexible pavement structures. Covered are: Traffic Analysis; Material Analysis; Alternate Designs; and Economic Analysis and Selection of Design. An Appendix A outlines compaction requirements and Appendix B contains four examples of how thickness designs are determined. Price $.20.

N. B. There is a charge for this book. Make checks payable to The Asphalt Institute.

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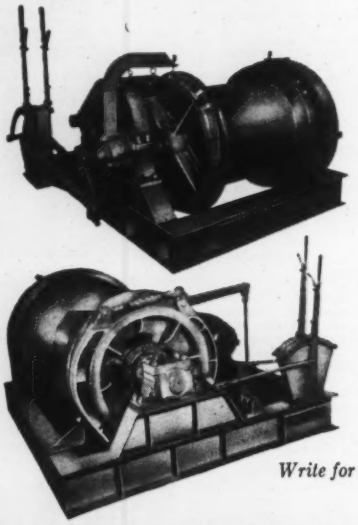

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CATALOG DIGESTS

216 THREE-AXLE TANDEM ROLLER

Buffalo-Springfield Roller Company—The KX-25E tandem roller is featured in a new catalog. With exclusive walking-beam compaction control, the KX-25E is a heavy duty 3-axle tandem giving extra compaction where and when needed. Dimensions, specifications, weights, compressions chart and cut-away diagrams are included in the catalog.

217 THREE-WHEEL ROLLER

Galion Iron Works & Mfg. Co.—Outstanding features of the "Chief", a three-wheel roller with Roll-O-Matic torque converter drive are illustrated with color photos. Attachments and specifications are included in Catalog No. 410.

218 THREE-WHEEL ROLLERS

Buffalo-Springfield Roller Company—Three-wheel rollers with powered hydraulic roll brakes and tapered roller bearings on all rolls, an exclusive performance feature of these rollers, is described in a 10-page catalog. Made for heavy-duty, they are variable in weight: the two models range from 10-14 tons and 12-15 tons.

219 TIDE GATES

Brown & Brown, Inc.—New literature fully describes a complete line of metal tidal gates in 22 circular sizes and 47 rectangular sizes. Also described are timber gates to meet any requirements and a line of cushioned flap gates for use on pump discharge lines. Dimensional and loss of head data are given.

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220 TIRE CHANGER

Dixie Tallyho, Inc.—A new bulletin describes and illustrates the Tirematic, which removes tires safely, quickly and easily. Used by the U. S. Government and State Highway Departments, it is available in three models, each pictured in the bulletin.

221 TRACTOR SHOVELS

Allis-Chalmers Mfg. Co.—Operating, performance and maintenance advantages provided by HD-16G and HD-21G tractor shovels are told through pictures and story in a new 8-page, 2-color catalog now available. Also included are engineering, design and construction features of these two models, which, with aforementioned advantages, provide the big capacity, cost-cutting and versatility users want and demand in their equipment.

222 TRANSITE PRESSURE PIPE

Johns-Manville Corp.—"Transite Pressure Pipe and the Ring-Tite Coupling" is an illustrated, 8-page booklet which describes methods in producing this asbestos-cement pipe for water systems and also describes savings in installation time and outlines characteristic advantages once the pipe is in the ground. Step by step, it gives recommended procedures for installing the pipe and assembling the Ring-Tite Coupling. A table of sizes and classes is included.

223 TRANSITE SEWER PIPE

Johns-Manville Corp.—"Transite Sewer Pipe with Ring-Tite Coupling" is a new 8-page booklet which illustrates and explains economies which this asbestos-cement pipe can effect in the design, installation, operation and maintenance of a sewer system. It shows how the Ring-Tite Coupling makes tight joints more quickly. It covers related items such as the Transite Sewer Pipe Fitting for connecting to Transite building sewer lines. The booklet concludes with a table of sizes, weights and crushing strengths.

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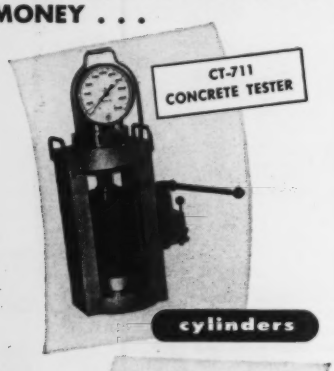

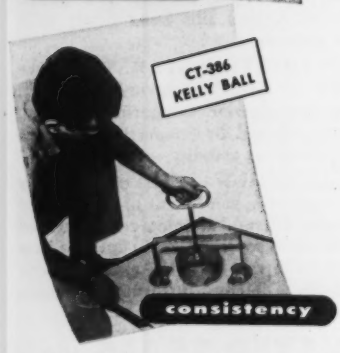

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CATALOG DIGESTS

224 TRI-ACETATE SHEETS

Stanpat Company—circular describing their printed adhesive-backed acetate sheets for speeding up drafting is available. These sheets are attached to original drawings and save draftsmen from redrawing standard details and repetitive notes. Resulting prints are clear and sharp and save tremendous amount of time.

225 TRIPODS

Kern Instruments, Inc.—An illustrated pamphlet describes new self centering tripod for surveying instruments manufactured by Kern & Co., Ltd. of Asrau, Switerland. These tripods greatly facilitate centering and setting up over a point and are the first radical improvement in this field since the wide frame tripod was developed in 1911. Setting up and leveling a Kern theodolite over a point with the new Centering Tripod can be done in about 1½-min., regardless of wind conditions.

226 TUNNEL MAINTENANCE AND REPAIR

Intrusion-Prepakt—An illustrated reprint of a paper presented before the American Concrete Institute discusses the causes of tunnel failures and how unique Intrusion-Prepakt methods and materials are employed in their rehabilitation. The article describes in detail repair procedures in three typical railroad tunnels. The I-P techniques can be adapted to new tunnel construction.

227 TUNNELS

Spencer, White & Prentis, Inc.—"Famous Subways and Tunnels of the World," by Edward and Muriel White recounts the fascinating history of subways and tunnels from earliest times. The price is $2.75.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

228 UNCONFINED COMPRESSION TESTING

Soiltest, Inc.—A new 54-page manual on Unconfined Compression Testing of cohesive soils. The manual covers in detail the types of unconfined compression test apparatus, preparation of samples, detail test procedures, interpretation of test results and the use of these results in design and research activity.

229 UNDERPINNING

Spencer, White & Prentis, Inc.—"Underpinning," a book by Edmund Astley Prentis and Lazarus White is recognized as the authoritative source for information in the field by engineers, architects and contractors all over the world. The price is $10.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

230 UTILITY AUGER DRILLS

Salem Tool Co.—A new 2-page, 2-color brochure explains the regular duty and heavy duty Trench Type Utility Auger Drill for boring under streets, highways, turnpikes, and railroads for laying of pipe lines, gas, oil, water, etc. The drill bores dry holes from 2- to 36-in. diameter. They can be equipped with pipe pushers. Special drills are designed for many jobs.

231 UTILITY CATALOG

Fisher Research Laboratory—The new 1957 Fisher Utility catalog of M-Scope electronic instruments for utilities is now available. Included are the M-Scope pipe finders, 2 new transistorized leak detectors, a completely new line of transistorized corrosion control instruments, and water well testing equipment.

232 VALVE AND REMOTE CONTROL SYSTEM

S. Morgan Smith Co.—A new catalog describes a standardized "package" of SMS-Rotovalve or R-S Butterfly Valve and controls. Designed to satisfy, either singly or in combination, basic applications where you need precise positioning and indication, or remote control, it is suited to water and sewage works applications or industrial processing. The system consists of valve, packaged hydraulic positioner or electric-motor-operator placed next to valve, and master remote unit which controls operation from locations a few or many miles away.

233 VALVES AND FITTINGS

Stockham Valves & Fittings—Detailed construction features of Stockham's complete line of valves are given in a new 6-page folder. Photographs, diagrams and tables are used to describe these double disc gate valves.

234 VALVES, HYDRANTS, ACCESSORIES

M & H Valve and Fittings Co.—A 136-page catalog, 8½ by 11-in. hardback, permanently bound, listing complete line of materials for water works, sewage plants, industrial plants and fire protection systems, is now available.

235 VANE SHEAR TEST KIT

Acker Drill Co., Inc.—Acker Bulletin 700 describes a new vane shear test kit for obtaining in place soil shear strengths. Kit includes a complete set of attachments for making shear investigations to 100 ft depths in 2½, 3 or 4-casing pipe.

ENGINEERING

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800 copies of the U.S.A.'s contribution to the EUSEC conference in Paris in September, 1957, are now available. Published for Engineers' Council for Professional Development, the 64-page book should be of much interest and value to educators.

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CATALOG DIGESTS

236 VERSATILE CAST IRON PIPE

Cast Iron Pipe Research Assoc.—A new illustrated booklet provides pictorial proof of the ruggedness and durability of cast iron pipe in water supply and distribution systems; feeder and distribution mains for the gas industry and sewer mains; and industrial service.

237 VERTICAL TURBINE PUMPS

Layne & Bowler, Inc.—A 72-page hard-back book entitled "The Answers to your Questions about Layne Vertical Turbine Pumps" is ideal for quick reference, complete with cut-away diagrams, illustrations, pictures and charts, and written by one of the foremost authorities on vertical turbine pumps.

238 VERTICAL WATER WELL

Ranney Method Water Supplies, Inc.—The newest development in the vertical waterwell field is the subject of a new brochure. Called the Vertube, it is a natural gravel vertical water well, designed exclusively for low volume users, at low cost. A diagram of the well completes the brochure.

239 VIBRATORY EQUIPMENT CATALOG

Jackson Vibrators, Inc.—Multiple Compactors for maximum consolidation of sub-base courses in macadam construction, fills, etc. Manually guided Compactors for paving blacktop walks, drives, pavement patching, widening, consolidation of granular soils in trenches, close to abutments, concrete floor sub-bases, etc.; Concrete Vibratory Screeds; Vibratory Tubes for Internal and Surface Vibration in Concrete Paving; General Construction Vibrators; Portable Power Plants.

240 VIBRATORY ROLLER

Bros, Inc.—A concise piece of literature illustrates the new Bros vibratory roller. It tells why the Vibra-Pactor can achieve maximum dry densities quickly in cohesionless or granular soils.

241 WATER CONCENTRATE

Deynor Corp.—A 4-page bulletin describes Veriwet, a new wet water concentrate and the Deynor wet water mixer. Veriwet is a combination of powerful wetting agents formed in a wax-like cylinder. It is able to permeate materials which are difficult to wet with plain water. The booklet also includes numerous recommended uses for this solution.

242 WATERSTOP MANUAL

The Durajoint Technical Information Center—Contains complete information on Durajoint and Duraseal Polyvinylchloride-PVE Waterstops, for expansion and construction joints. "Durajoint" was specifically compounded and designed for use between adjacent sections of concrete structures. "Durajoint" may be spliced on the job by merely applying heat and holding the ends together until bonded. Requires no welding or vulcanizing equipment.

243 WATERSTOPS

Water Seals, Inc.—A colorful eight-page brochure illustrating a complete line of waterstops along with the particular job application of each is available. Polyvinyl waterstops are flexible enough to withstand extreme joint separation, yet are rigid enough to stand up to the battering effect of pouring concrete. The stops are unaffected by acid, alkalies, petroleum products, chemicals or adverse atmospheric conditions and will not rust, rot, check or crack.

244 WATERSTOP TECH-TIPS AVAILABLE

Durajoint Technical Information Center—has ready for distribution, a complete series of Durajoint "Tech-Tips." This series of technical data sheets tells where, why and how to use Durajoint Waterstops. Graphically illustrates how to form-work, install, set-up and how to quickly and easily splice this Waterstop on the job. Covers many applications.

245 WATER SUPPLIES

Ranney Method Water Supplies, Inc.—"Supplying Water for Municipal and Industrial Use," a 20-page catalog, explains how the Ranney Method can provide any type of water program for these uses. Horizontal collectors, infiltration galleries, vertubes, and intakes are fully described. Photographs and schematics depict each operation.

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246 WELDED AND RIVETED GRATINGS

Klemp Metal Grating Corp.—A newly revised 4-page brochure details specifications, safe load tables, diagrams, descriptions, etc., of Klemp welded and riveted gratings, Riv-Dexteel and varieties of stair treads. Technical drawings indicate installation and applications of these products.

247 WELDED GRATING

Globe Co.—The Gold Nugget Grating is a heavy duty grating of lighter weight made by a new type of projection weld that results in a strong, versatile open steel floor grating to complement Globe's Grip-Strut grating. A new 28-page illustrated catalog shows the details of this grating, which is suited for powerhouses, oil refineries, drain grates, loading docks, fire escapes, plating or filtration rooms, sidewalk grating and all types of heavy duty platforms.

248 WELLPOINT DEWATERING

Griffin Wellpoint Corp.—"How to Handle Wet Jobs," a new brochure presenting successful solutions to unusual pre-drainage problems is now available.

249 WELLPOINT DEWATERING

Griffin Wellpoint Corporation—"The Wellpoint System in Principle and Practice" is a handbook of the fundamentals of wellpoint dewatering and is applicable to any wellpoint system regardless of manufacture. This handbook contains information on how a wellpoint system functions, and methods of planning, layout, installation and removal of the system. The manual is pocket size, 109 pp in length and contains 62 diagrams and illustrations. The price is $1.50.

N. B. There is a charge for this book. Make checks payable to Griffin Wellpoint Corporation.

250 WELLPOINT DEWATERING SYSTEM

Griffin Wellpoint Corporation—A catalog describes the many items of Griffin wellpoint equipment together with pump capacity charts. It contains a series of actual job photographs showing this equipment on various types of construction projects.

251 WELLPOINT DEWATERING SYSTEM

John W. Stang Corporation—A 100-page catalog describes the component parts of the Stang wellpoint unwatering system; its planning, engineering and various methods of installation. Numerous recent projects have been added to demonstrate either a new application or some novel technical feature in the engineering and installation of the wellpoint equipment. Specific installations on dams, powerhouses, pipelines, tunnels, are illustrated from photographs made in the field. Heavy construction of all types in all varieties of soil conditions where ground water is encountered is described fully.

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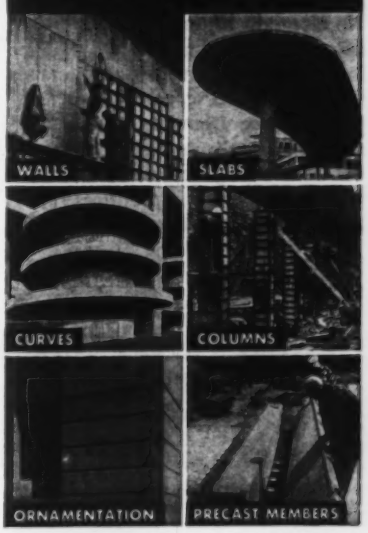

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Austin, Tex., Hotel S. F. Austin,
Booth 30–31

★ American Society of Civil Engineers
October 14–18, 1957
New York City, Hotel Statler,
Booth 11–12

CATALOG DIGESTS

252 WELLPOINT SYSTEM

Moretrench Corporation—an informative 76-page catalog, fully illustrated, describes the Moretrench wellpoint system and its use in dewatering various types of construction projects. It includes useful technical data on the system.

253 WELL WATER SYSTEMS

Layne & Bowler, Inc.—Well water systems, pumps, drilling, as well as allied services and equipment are the subject of a new 4-page bulletin. The folder describes the products manufactured by Layne, which has specialized in the development of ground water for over 75 years.

254 WHITEPRINT MACHINE

Ozalid Div., General Aniline and Film Corp.—A new bulletin describes the Streamliner 200 whiteprint machine, a low-cost full-width table model, which will accommodate materials of any length up to 42-in. wide. Operation of the 200 is simple. The controls—speed, ammonia, on-off—are easy to read, reach and work. The unit's print receiving tray will stack materials up to 24-in. long. The bulletin includes specifications.

255 WOOD PRESERVATION

Wood Treating Chemicals Co.—The purpose of the booklet "What They Will Ask About Penta" is to provide information about this chemical creation. While not a new product—actually it was first used a century ago—Penta is not well-known to the general public. Questions such as what is Penta; how does it work; where can it be used, etc., are carefully discussed.

256 WOOD & STEEL TYPE DOORS

The Kinnear Mfg. Co.—The catalog and data book discusses fully and illustrates the advantages, the economy, the construction features and the general specifications of the various types of wood and steel upward-acting type doors. Known as Bulletin 93 it gives information on installation, clearance requirements, methods of operation and controls, as well as adaptability of the doors for many types of uses.

257 ZEOLITE WATER SOFTENERS

The Permutit Company—Bulletin 2386-B, describes troubles caused by the utilization of hard water and the multiple economies effected by curing them. This 20-page bulletin should be of interest to all engineers dealing with water problems. Equipment specifications, operating characteristics, data on Permutit ion exchange resins and typical installation photographs have been included in this new edition.

258 ZEOLITE WATER SOFTENING

General Filter Co.—Engineers will be interested in this new 12-page bulletin which is well illustrated and contains data and capacities of softening equipment.

259 BRONZE PRODUCTS

M. Greenberg's Sons—Consisting of 148 pages in color, Catalog T features a complete line of bronze products including valves, hydrants, fittings and plumbing specialties. A special section also illustrates bronze plaques, letters and tablets.

260 ADJUSTABLE CURVE DRAFTING INSTRUMENT

Albert G. Daniels—A 4-page folder with photographs, specifications and prices illustrating the adjustable Curve Drafting Instrument is offered. These handmade instruments, placed on the market over ten years ago, continue to provide the draftsman with an easy, convenient way to obtain curves of long radius, and also irregular curves. Calibrated scale indicates actual radius of curvature or degree of curvature.

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PROCEEDINGS AVAILABLE

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September

1352. Irrigating in the Humid Areas, by E. A. Kimbrough, Jr. (IR) A comparison is made of the problems of irrigating in the humid area with those of the arid area. The paper considers the development of flow for irrigation involving drainage requirements, crop response, and labor requirements.

1353. Pin-Ended Gabled Frames, by James Chinn. (ST) This paper presents a method for solving pin-ended, one or two span, gabled frames by the method of consistent deformations. It utilizes moment distribution coefficients but does not require actual distribution of moments.

1354. Lateral Deflections and Stresses in Building Frames, by Robert E. McClellan. (ST) This paper demonstrates a method of analyzing multi-story rigid frames for deflections and stresses caused by lateral loads, based on structural properties of frame members. The sources and probable magnitude of error in calculated stress and deflection are discussed.

1355. Design of Multi-Level Guyed Towers: Wind Loading, by Edward Cohen and Henri Perrin. (ST) Methods are presented for computing wind loads on trussed frameworks as functions of wind velocity, solidity ratio, member shape, shielding, yaw and slenderness ratio. Shape factors for towers are proposed and compared with test data.

1356. Design of Multi-Level Guyed Towers: Structural Analysis, by Edward Cohen and Henri Perrin. (ST) Methods are presented for the structural analysis of multi-level guyed towers as continuous beam columns on yielding supports including effects of vertical guy reaction eccentricity, shaft distortion and torsion. Equations are given for analysis of the guys and determination of spring constants at the tower shaft.

1357. University Research in Structural Engineering, by Frank Baron. (ST) Different attitudes toward university research in structural engineering are considered. The writer sets forth his own views with particular reference to three categories of research. These categories are defined and consist of analytical, experimental, and design research. Specific examples of each kind of research are illustrated.

1358. Ultimate Strength of Short Struts, by Seng-Lip Lee and P. Ballesteros. (ST) The determination of the ultimate strength of short struts of any cross section subjected to the action of eccentric loads or pure nonsymmetrical bending is treated in this paper. The analysis is based upon an idealized stress-strain relationship assuming constant stress for strain beyond the yield point.

1359. Salt Balance in Ground Water Reservoir Operation, by David B. Willets and Charles A. McCullough. (IR) Operation of ground water reservoirs for seasonal and cyclic storage of water requires maintenance of suitable mineral quality of the ground water. Sources and disposal of salts, requirements for water, and deficiencies in present knowledge and data collection are considered. Illustrative computations for a hypothetical ground water basin are included.

1360. A Graphical Solution for Flow in Earth Channels, by Isidro D. Cariño. (IR) This paper presents a graphical solution utilizing Manning's Formula for the design of earth canals with trapezoidal cross sections. These graphs were prepared for a specific value of the coefficient of channel roughness closely approximating that for earth canals.

1361. Duration of Load and Fatigue in Wood Structures, Progress Report of a Sub-Committee of the Committee on Timber Construction of the Structural Division. (ST) This paper summarizes present knowledge of the effects of long-time loading and of fatigue on structural wood. A chart showing the relation of safe working stress to duration of load is presented, and fatigue test data are reviewed. A section on the evaluation of old timbers in structures is included.

1362. Common Errors in Measurement of Irrigation Water, by Charles W. Thomas. (IR) The paper discusses errors which occur when dimensions, settings, flow patterns and other factors do not conform to accepted standards for water measurement devices. It is concluded that equipment designed to give accurate measurements may not do so unless due care is exercised in fabrication, installation, operation and maintenance.

1363. Drainage in the Mississippi River Valley, by Louis W. Herndon. (IR) This paper explains the coordination between the Soil Conservation Service and the Corps of Engineers, U. S. Dept. of the Army, in drainage activities in the alluvial valley of the Mississippi River. The relation of flood control and drainage is discussed and the different elements of complete surface drainage systems are described.

1364. Water Use in Industry, by Ray L. Derby. (IR) The paper presents various factors of use and demand for water on the water purveyor's system by industry. Factors of quantity and quality are considered. Potentialities and economics of re-use of water within an industry, and use of sewage and other municipal waste waters are discussed.

1365. Telemetering Hydrologic Data, by Francis P. Hanes. (WW) Automatic equipment is described to fulfill a requirement for optimized operation of reservoirs and other flood control structures by allowing rapid and unattended reporting of river levels and precipitation amounts from remote points. The emphasis is on design of telemetering devices and system engineering for VHF radio transmission of data.

1366. Cellular Cofferdams, and Docks, by E. M. Cummings. (WW) This paper covers a new theory of design for cellular cofferdams against failure by tilting, which is substantiated by results of model tests. The proposed theory is used to investigate the design of two actual structures, a cofferdam on rock, and a dock in sand. Several previously published theories are also discussed.

1367. Model Studies of Remedial Works for Niagara Falls, by A. P. Rollins, Jr., and G. B. Fenwick (WW) Model studies were made to determine the effects of increased diversions of Niagara waters for power and to design remedial works to enhance the scenic spectacle at Niagara Falls. The works developed consisted of a gated control structure in the river above the Cascades and combination excavations and fills at both flanks of the Horseshoe Falls. Subsequent field observations have verified model predictions.

1368. Offshore Breakwaters, by Richard Silvester. (WW) The determination of wave height and wave pattern for waves diffracted by an infinitely long breakwater, or by a backwater gap, has been based on the theoretical solution for optical diffraction. Model tests for wave patterns with two different lengths of breakwater and waves of different steepnesses are described and results presented in a form suitable for application.

1369. Great Lakes Harbors, by Edwin W. Nelson. (WW) This paper discusses improve-

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ments in Great Lakes channels and harbors which will be required as a result of the projected completion of the St. Lawrence Seaway. The paper covers both the connecting channels between the lakes as well as harbor channels. Pier and breakwater reconstruction is also discussed.

1370. Operation of Missouri River Main Stem Reservoirs, by R. J. Pafford, Jr. (WW) The paper describes the six main stem multiple purposes reservoir system built under the Pick-Sloan program adopted in 1944. It outlines the main features of operation of these reservoirs in the interest of flood control, irrigation, water supply and sanitation, power, recreation, and fish and wild life. The development of the highly complex operating plans and criteria is discussed.

1371. The City's Place in the Expanded Highway Program, by Alfred Berarducci and Glen C. Richards. (HW) This paper recommends that cities must take the initiative to secure their just participation in the expanded highway program. Two important steps are suggested; that cities must develop a practical highway needs program, and must establish a suitable relationship with their state government to provide the financing for necessary projects.

1372. Direct Solution for a Triple Spiraled Compound Curve, by Alfred C. Scheer. (HW) The analytical solution presented in this paper is believed to be somewhat shorter and more fundamental than the traditional solutions. After the tangent distances of the unspiraled compound curve have been computed, all that remains are a few easy calculations which may usually be done by slide rule with sufficient accuracy.

1373. How to Increase the Productivity of Highway Engineers, by G. I. Sawyer. (HW) There are three vital factors with which State Highway engineers must concern themselves in increasing the productivity of their staffs; namely, personnel, engineering techniques and morale. The effects of these factors are described and evaluated.

1374. Operation of Urban Expressways, by Joseph Barnett. (HW) Urban freeways and parkways often break down at peak volumes, stopping all traffic. This paper explains the reason for such stoppage when caused by too great traffic density, suggests a procedure for analyzing traffic thereon, and proposes that traffic entering expressways be controlled so that volume is kept well below possible capacity to insure free movement.

1375. Hydrostatic Testing of Pipelines, by Leon E. Brooks. (PL) This paper considers hydrostatic testing of pipelines, which has become a principal method of testing for the following reasons: rehabilitation of old systems, increase in pipelines, advances in pipe manufacture, industry reapproval of current codes, and natural advantages of water testing.

1376. Route Surveys for Offshore Pipelines, by Clyde Aldridge. (PL) Route surveys for offshore pipelines present some problems not normally associated with route surveys on land. This paper reviews some of their problems and the equipment and methods used on a 12-in. pipeline laid offshore of the coast of Louisiana.

1377. Discussion of Proceedings Papers 1103, 1236. (IR) R. G. Kazmann closure to 1103. Gordon E. Williams on 1236.

1378. Discussion of Proceedings Paper 1090. (HW) Corrections to discussion by Angel Villasor, Jr.

1379. Climatic Influences on Crop Water Requirements, by Thomas C. Skinner. (IR) In the past decade, water requirements of plants as influenced by climate have received considerable study and experimentation. This paper presents a discussion of the work that has been done in the field of crop water requirements to date, with particular emphasis on work done at the University of Florida in Gainesville, Florida.

1380. The Consulting Engineer's Role in the Highway Program, by Elmer B. Isaak. (HW) Engineering the enlarged Federal Aid highway program is a task which will require all available talent. State highway departments will administer the work, but must supplement their own technical forces with consultants. Consulting engineers must assume a real responsibility, constantly endeavoring to find the best solutions and using their ingenuity to advance the standards of highway building.

1381. Discussion of Proceedings Papers 965, 1119, 1208. (WW) Frank H. Newnam, Jr., closure to 965. S. H. Wearne on 1119. Gerard Tison, Jr. on 1208.

1382. Discussion of Proceeding Papers 809, 1054, 1058, 1096, 1097, 1146, 1147, 1149, 1150, 1151, 1187, 1188, 1189, 1190, 1314. (ST) Committee closure to 809. M. G. Spangler closure to 1054. F. J. Cain and G. Luck on 1058. Otakar Ondra closure to 1058. Henry M. Lummis III on 1097. Edwin W. Thomas on 1146. Yves Nubar on 1147. James H. Shellhammer, Raman Pichumani, and John R. Verna on 1149. A. J. Francis on 1150. Walter M. Zalite on 1151. Howard H. Mullins, Jerry C. L. Chang on 1187. Albert O. Grote, J. V. Du Plessis on 1188. Anthony M. DiGioia on 1189. Reinaldo Garcia-Iturbe on 1190. Raymond Archibald on 1314.

1383. Discussion of Proceedings Papers 1194, 1195. (PL) Corrections to 1194. Henry M. Paynter on 1195.

1384. The Soap Lake Basin, by Keith E. Anderson. (IR) Soap Lake, a natural body of mineralized water without surface outlet, lies within the Columbia Basin Project in Washington. Initial irrigation flows, coinciding with above-normal precipitation, upset the delicate inflow-evaporation balance causing flooding of adjacent areas and dilution of the allegedly therapeutic waters. Inflow-outflow studies permitted estimation of inflows attributable to irrigation.

1385. Significance of Tests for Highway Materials Basic Tests, by Committee on Significance of Tests for Highway Materials, Highway Division. (HW) Tests for highway materials which are considered basic in soils, bituminous materials, and concrete aggregates areas are discussed to include the significance of test results. In addition, synopsis of test method, typical test results, and influences of the method of test are indicated for each test.

1386. Metropolitan Traffic and Highway Problems, by Murray V. Jones. (HW) The Metropolitan Corporation was incorporated in 1953 to solve major problems of the area created by phenomenal growth, uncoordinated municipal planning and a high standard of living. To solve highway and traffic problems, a coordinated transportation administration was created to plan for, construct and operate transportation facilities. After three and one-half years it has been shown that this form of administration provides the most efficient manner in which to solve problems of interrelated communities.

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